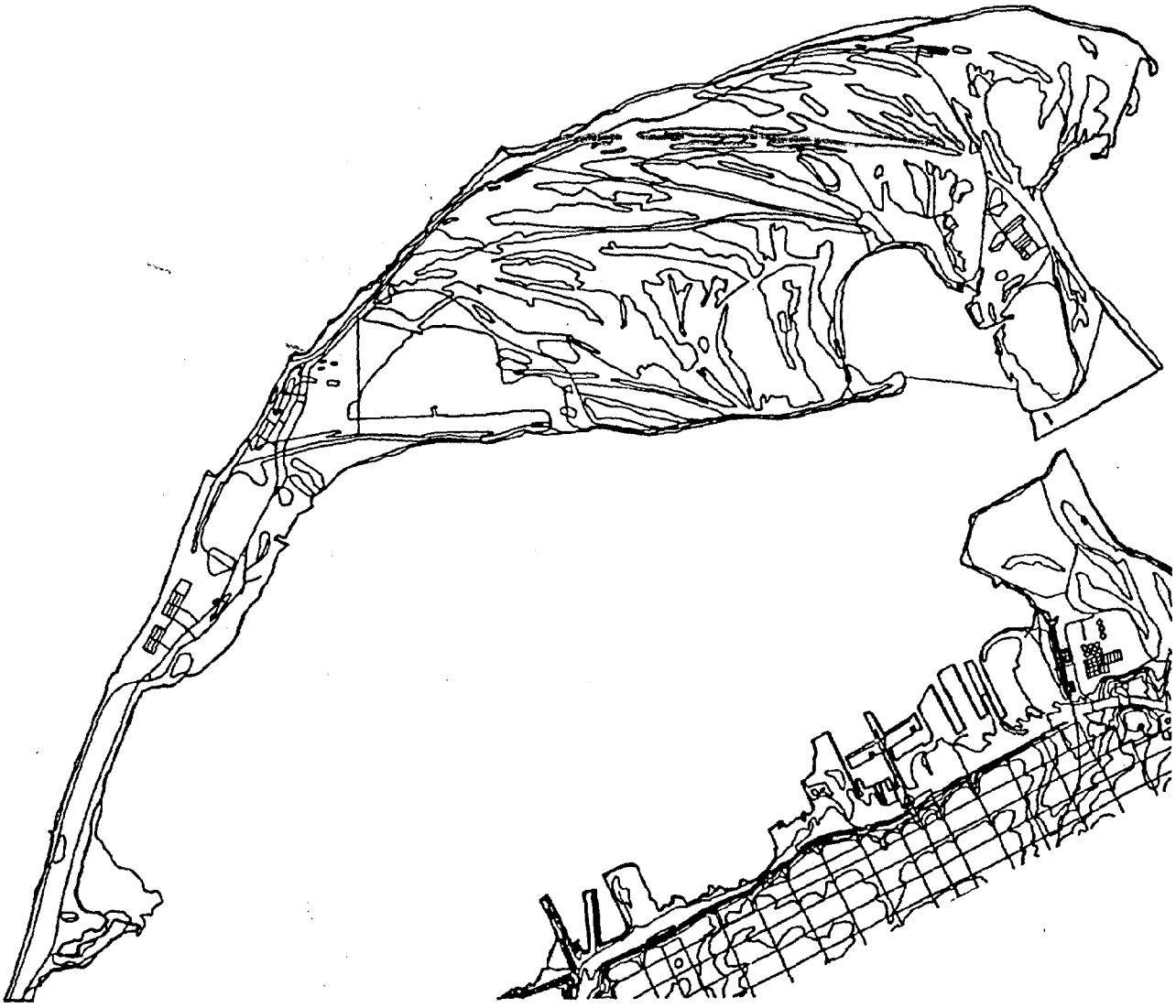
PRESQUE ISLE STATE PARK
PILOT
GEOGRAPHIC INFORMATION SYSTEM

OCTOBER 1994



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Department of Environmental Resources
Bureau of State Parks
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Harrisburg, PA 17105

Pennsylvania Coastal Zone Management Program

Analog and Digital Topographic Map
of
Presque Isle State Park

DER Grant/Contract No. C21:92.02PS

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A Report of the Pennsylvania Department of Environmental Resources

to the

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Pursuant to

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Coastal Zone

Funded and coordinated through Department of Environmental Resources, Office of Resources Management, Bureau of Resources Management, Division of Coastal Zone Management and the Erie Coastry Department of Planning.

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A special thanks goes to Donald Hoskins, Christina Dodge, and Thomas Whitfield of the Bureau of Topographic and Geologic Survey for their assistance and coordination of the agreement with the U.S. Geologic Survey and producing products for use.

Thanks to U.S. Geologic Survey Eastern Mapping Division for their assistance on developing the coverage and overall GIS program for Presque Isle State Park.

Special acknowledgement goes to Regis Crawford and the staff of the Bureau of Facility Design and Construction, for his help with establishing survey control points for use with the program. Also, with his help in determining GPS standards and methods to be used at Presque Isle State Park.

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Without the guidance and help of Craig Reed and Sally Holbert of Earth Information Services the project would not have progressed as quickly and had sufficient standards developed. Thanks for your patience and assistance on this project.

Without the help of James Bissell, Cleveland Museum of Natural History and Eric Jesperson, Planned Dynamics Inc. the additional coverages that state parks wanted and didn't have the information could not have been developed.

Cooperation is a must with any Geographic Information System and without the information provided by the U.S. Army Corps of Engineers, Buffalo District, the Bureau of State Parks would not have historical shorelines to compare. Therefore a thanks goes out to the staff at Buffalo.

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EXECUTIVE SUMMARY

Presque Isle State Park is a seven-mile peninsula, encompassing approximately 3,200 acres in size. The state park is managed by the Bureau of State Parks, Department of Environmental Resources, Commonwealth of Pennsylvania, for recreation and conservation purposes. As the years past and numerous yearly storms pound away at Presque Isle State Park's shoreline, erosion and sedimentation occur along this shoreline. This results in a change of the shoreline and a continuous growth of the state park. As a result of this constant change a program needed to be devised to provide an up-to-date base map of the state park.

This project documents what is available, resource wise at the state park, types of equipment purchased, training performed, technical assistance, and future plans. It states standards set forth for the Bureau of State Parks to use in data collection and mapping. The project was completed through joint ventures with the state and federal agencies as well as private corporations and individuals.

This report has been organized to present the background, historical, physical characteristics, and recreational facilities of Presque Isle State Park in Section 1. Section 2 deals with the project initiation which include the meetings, agreements, equipment purchases, and training. The various ways in which data was collected is explained in Section 3. Section 4 deals with the standards used on the project and establishes a starting point for a Geographic Information System plan for the Bureau of State Parks. The final budget is explained in Section 5. A discussion on the system and the current uses of it are explained in Section 6 along with ideas and future considerations for various applications.

The overall goal of this project was to provide a modern, up-to-date, accurate geographic data base map in digital and cartographic format for use by the state park system in managing Presque Isle State Park resources.

This project was a pilot project to collect very detailed topographic data and to prepare an up-to-date lithographic map of the state park for managing the state park for recreational and conservation purposes. In addition, data would be collected digitally for use on a state park operated P.C. computer system that would allow augmenting and monitoring digital data as it is modified through management decisions and as the shoreline is affected by rising and falling lake levels. The project included data acquisition which meets standards for use of Department-approved computer systems; provision of necessary software and hardware, and training for state park personnel to operate systems.

The program has been developed to the point that Arcview 2 will be used at the park to run applications and do some editing and application development. Overall responsibility for the basic coverage will be the Central Office staff of the Bureau of State Parks. Presque Isle State Park will be able to produce any map of any scale for coverages that have been created along with database reports.

The 92 CZM grant was the first phase of the project with the 93 CZM grant as Phase II to be completed in 1995. The Geographic Information System is a dynamic tool that will continue to grow and actually never be 100 percent complete.

Phase II of this project will complete and/or enhance coverage that are in development, write applications for their use, and develop additional coverages to meet the needs of Presque Isle State Park.

The following are the recommendations that the Resources Management Section will make to the Bureau of State Parks with the CZM project is complete:

- To take the information from this project and Phase II and develop a Geographic Information System Plan for the Bureau of State Parks before continuing with future applications.
- To use State Plane, NAD 83 as the standards projection for state park maps.
- To establish a GIS coordinator to oversee the GIS program in BSP.
- To require a inkjet plotter for maps upto 17" x 11" in size.
- To use GPS equipment for collecting of data within the park boundary. The 1-2 meter accuracy will be a major improvement in the quality of state park maps and will be an acceptable error factor.
- To use the Department's cardiographic section to digitize existing accurate maps into Auto Cadd for use by Resources Management Section. The Resources Management Section will use Arc CAD to take maps between Arc Info and Auto CADD.
- To acquire Arc CAD and Arc Scan modules for Arc Info for use with the GIS program.

1.0 INTRODUCTION AND BACKGROUND INFORMATION

This section of the report describes the purpose of the project effort, discusses the historical setting, natural resources, recreational opportunities, and shoreline processes of Presque Isle State Park.

1.1 Purpose of Study

Presque Isle State Park is a seven-mile peninsula, encompassing over 3,200 acres in size. The state park is managed by the Bureau of State Parks, Department of Environmental Resources, Commonwealth of Pennsylvania, for recreation and conservation purposes. As the years past and numerous yearly storms pound away at Presque Isle State Park's shoreline, erosion and sedimentation occur along this shoreline. This results in a change to the shoreline and a continuous growth of the state park. As a result of this constant change a program needed to be devised to provide an up-to-date base map of the state park.

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1.2 Historical Setting of Presque Isle State Park

In terms of historical records, Presque Isle State Park was discovered and named by the French in the 1720's (French Explorers). The name Presque Isle State Park when translated into English means *"almost an island."*

However, there is little doubt that Presque Isle State Park was occupied by Indians prior to the arrival of the French. The earliest native American inhabitants that we can identify by name were the Erie's, who were in possession of this region until their defeat and extermination by the Iroquois in 1650. From what we know of the Erie's they were a somewhat domesticated people who could have cleared portions of the peninsula for use in farming and possibly even settlement. But this can only be termed speculation since there have not been any archaeological investigations to verify that fact. Subsequently the Seneca nation of the Iroquois Confederacy controlled the area, but they were primarily warriors, and it is doubtful they would have used Presque Isle State Park for anything more than a hunting preserve.

French Period (1720-1759). The French did not come to northwestern Pennsylvania for settlement, but to establish a series of military outposts with which to resist the encroachment of the English. To them the peninsula had great strategic value as it afforded natural protection for the harbor and against attack from the water. Two sites have been identified - one at the neck of the peninsula and the other at the easternmost tip, where the French may have erected military installations. Both structures are said to have been made of brick.

British Period (1760-1763). Following their defeat by the British in the French & Indian War, the French burned their fort on the mainland at the mouth of Mill Creek, and abandoned their claims to northwest Pennsylvania. However, they were still a presence, and this along with the threat of Indian attack prompted the British to erect fortifications of their own. But, they did not replace the French fort, they simply built a blockhouse on the same site. A separate outpost and stockade were constructed at the neck of the peninsula for the grazing of animals.

The British in turn were evicted from this area by the Indians during Pontiac's Rebellion in 1763. The blockhouse on the mainland was destroyed. Presumably, the post on Presque Isle State Park suffered the same fate.

No-Man's Land (1764-1794). The ferocity of the attack and continuing Indian antagonism discouraged the British from any further fortification or settlement of this region. Records of what transpired during this thirty year period are extremely vague. This was a time in which the focus of the contest for domination first between the Indian and white man, and later after 1771 between the Americans and British, shifted further west. The destiny of northwest Pennsylvania was settled at negotiating tables and in strife far removed from Presque Isle State Park. Out of these negotiations came a resolution to a dispute over ownership of the Erie Triangle which included the northern half of Erie County and the peninsula. In 1792, Pennsylvania was able to purchase the disputed territory from the Federal government. There is some evidence to suggest that there was a trading post here during these years, which was visited from time-to-time by white men, both British and American.

American Military Period (1795-1825). The defeat of the western Indians by Anthony Wayne in 1795 finally cleared the way for permanent settlement of this region by the Americans. However, the British continued to intrigue the Indians which posed a threat to the new village at what was then called Presque Isle State Park. That such a threat existed was recognized in the 1794 act authorizing the laying out of the town, which reserved a "tract of 100 acres on the peninsula, for the use of the United States in erecting forts, magazines, arsenals, dockyards, etc." The need for such fortifications became a reality in 1812 with the outbreak of war with England.

Battle of Lake Erie. Presque Isle State Park harbored a naval base during the War of 1812. It was here that Commodore Perry built his ships and trained his men for the coming battle.

On September 10, 1813, the British and American fleets clashed in a battle that became the turning point in the War. After Perry's victory, the fleet returned to Presque Isle State Park and erected a bunkhouse and storage building at Misery Bay. Misery Bay received its name from the hardships his men endured during the cold winter that followed.

In 1814, the brigs Niagara and Lawrence were sunk in Misery Bay in hopes of preserving them. They were raised again to commemorate the centennial of the War. The Lawrence was in such ill repair that it was sold for souvenirs. The Niagara was sunk again, later to be raised and fixed.

In 1813, a large blockhouse was constructed on Crystal Point just west of Misery Bay to guard the harbor entrance. This installation remained in operation until 1825. Also during this period Misery Bay served as a harbor for inactive vessels of the American squadron as well as captured vessels of the British squadron from the Battle of Lake Erie.

However, use of the peninsula was not entirely confined to military purposes and as the commercial potential of Erie's harbor became apparent toward the close of the period, the first-aid-to-navigation - a pierhead light, was installed on the north side of the channel entrance in 1819.

Public Works Era (1826-1920). With the diminished possibility of attack, attention now shifted from military concerns to the role of the peninsula in Erie's growing maritime trade. The immediate need was to improve the channel entrance, and this was done by the construction of a series of dikes and piers, under a $20,000 appropriation from the Federal government.

A further problem for the harbor occurred when the neck of Presque Isle State Park was breached by a storm in the winter of 1828-29. A second break in 1833 rapidly expanded to a width of one mile and was not fully closed by natural siltation until 1864. For a good part of this period, bulkheads were used to maintain a 400-foot wide navigation channel. In 1874, the peninsula was breached again. This break was closed the following year with 400 feet of pile and plank fencing strengthened with stone. These were just a few of the measures taken to arrest the erosion of Presque Isle State Park by the Federal government during this period. From 1829 to 1883, a total of $220,000 was spent on the construction of breakwaters, jetties, and protective fencing.

In other matters of Federal concern, the Presque Isle State Park Lighthouse, generally known as the flashlight was erected on the north shore of the peninsula in 1872. Three years later the first life-saving station was established on the north side of the channel entrance.

In connection with the above, it should be noted that Presque Isle State Park had many changes of ownership during this period, passing from the Federal government to the Commonwealth of Pennsylvania, then to the City of Erie, then to the Marine Hospital Corporation. Finally in 1871, legislation at both the Federal and State levels provided an arrangement whereby for purposes of national defense and protection of the harbor, custody and control of the peninsula was awarded to the United States; while for the purposes of all other matters subject to civil and criminal jurisdiction, actual title and ownership was vested in the Commonwealth of Pennsylvania. Since this legislation further stipulated that the peninsula was "to be held near as may be, in its present condition....," it appears that it was the intention to limit commercial use. To what extent this prohibition was followed is difficult to determine. We do know that a small fish processing plant was constructed on Misery Bay in 1874. It is likely that other ventures, such as boating and bathing concessions, were allowed as well.

In 1904, the City Water Commission was permitted to extend its intake pipe through the peninsula into Lake Erie. A concrete-lined settling basin was added to the system put into use on October 2, 1911. For the purpose of periodically emptying and cleaning the settling basin, a hollow tile pumphouse was built in 1917.

State Park Era (1921-Present). In 1921, for the purposes of creating a state park, Pennsylvania acquired outright ownership and control of Presque Isle State Park with the exception of that land immediately surrounding the lighthouse and Coast Guard station at the channel entrance, which was reserved to the Federal government. Thus, began the period of the most intensive development in the history of the peninsula. The first paved road was laid in 1924, which went to the lakeside so visitors could view the lake. It was during these years that many of the structures such as the cabins, picnic pavilions, the Nature Center building, boat livery buildings, etc., some that we still see today were constructed. Other structures such as sawmills, fire tower, etc., have since disappeared.

During the 1950s major changes were made to the state park to better accommodate the growing crowds. The neck of the peninsula was widened on the lakeside by the U.S. Corps of Engineers in 1956, when they placed 3,000,000 cubic yards of sand for a distance of five miles. This was followed by a major landfill operation on the bay side of the neck which was carried out by the Department of Forests and Waters.

When sand was taken from the area south of Long Pond to widen the peninsula, a large new 12-foot deep inland lake was created for the marina. The new peninsula neck, widened on both the lake and bay sides, was then sufficiently large enough to plan and start building a one-way traffic circulation system, with integrated off-street parking and beach facilities.

In 1957, three modern bathhouses were completed, each unit with a 1,100 car capacity parking area. New toilet facilities were provided. Over three miles of water main was laid in 1958. The present state park administration building was built in 1962.

1.2.1 History of the Erosion on Presque Isle State Park

The action of waves and littoral currents cause erosion on the Lake Erie side of the peninsula and deposition at the distal end of the peninsula. The net effect of this erosion and deposition is to cause a gradual movement of the land mass from west to east. In the past, prior to the installation of groins and a rock protected steel bulkhead, the neck of the peninsula had on occasions been breached during severe storms. In 1917, the breach was wide enough to accommodate small boat navigation between the lake and the bay.

Since the year 1819, the Federal and State governments have maintained the peninsula and have combatted the erosion on the lakeside shore. This obligation has resulted in a considerable effort to stabilize and replenish the beach areas. Perhaps the largest project in the past was in 1956, when the Corps of Engineers installed much of the groin and bulkhead system along the neck of the peninsula, and pumped sufficient sand from the bay to replenish the beaches from the neck to the lighthouse.

Since 1956, activity has primarily been directed toward beach maintenance by sand replenishment. During 1972 and 1973, an experimental grout filled nylon bag reef was included in the sand replenishment contract in an attempt to reduce sand losses from Beach 6. In 1978, breakwaters were placed in the Beach 10 area as another experimental step in beach erosion control. This resulted in sand build-up to the lee of the breakwaters with severe erosion to the east.

1.3 Natural Resources

This section contains a brief narrative of the natural resources found at Presque Isle State Park. The project area includes all of Presque Isle State Park and 500 feet out from the shoreline.

1.3.1 Physiography

Presque Isle State Park lies within the Eastern Lake Section of the General Lowland Physiographic Province and is an east-west trending sandspit, also commonly called a peninsula. Its westernmost (proximal) end is connected to the shore, while its easternmost (distal) end curves toward the shore, but is not attached. Approximately seven miles long, Presque Isle is hook-shaped

with the point recurved toward shore at the east end. Width at the neck is less than a thousand feet, while in the center and at the east end, width exceeds one mile. The spit forms an embayment, Presque Isle Bay, between its southern shore and the northern shore of the City of Erie. A channel at the east end of the bay is maintained by dredging to permit ship access to the harbor.

The sandspit formed sometime after the retreat of the last glacial advance on Erie County (11,000 years ago) and after the last stage of Lake Erie attained its current general elevation (3,500 years ago). Presque Isle State Park's elevation ranges from 572 feet above sea level at the lake shore to approximately 590 feet at some of the highest dunes. This difference yields a maximum relief of nearly 20 feet within the state park boundary.

The reason for the spit's location and origin is uncertain. Studies of old maps and aerial photos, the dynamics of the beaches and dunes, and processes along the lake shore suggest that the materials comprising it have been transported from the west. The probable source for most of the material is sediment carried by streams to the lake and material eroded from the lake bluffs. The sediment, composed predominantly of sand with lesser amounts of pebbles and cobbles, was carried by shoreline (littoral) currents and subsequently deposited to form the spit. At the time of its origin, the sediment supply from the downcutting, youthful streams entering Lake Erie was much greater than at present. As long as the sediment supplied to the spit was greater than the amount of sediment being carried into deeper waters east of the spit, the peninsula grew in both length and width.

1.3.2 Geology

Bedrock Formations Underlying Presque Isle State Park

Underlying the relatively thin veneer (approximately 100 feet) of sand and other glacially derived sediments which make up Presque Isle State Park, there is almost 6,000 feet of sedimentary rock. The sediments which make up this rock were deposited from 600 to 350 million years ago when this area was below sea level. The rocks consists of nearly horizontal layers of shale, limestone, dolostone (magnesium limestone), claystone, sandstone, and salt. The uppermost bedrock unit beneath Presque Isle State Park, the Devonian age Northeast Shale, is also exposed along the lake shoring in much of central and eastern Erie County. This rock is predominantly a gray silty shale, with thin layers of fine grained sandstone and calcareous (limy) layers and lenses. The bedrock surface beneath the peninsula slopes gently lakeward from about two feet below low water datum at the junction of the neck and the mainland to more than 100 feet below the surface at two gas well locations. The individual beds dip very slightly to the south, so that progressively younger rocks are at the surface south of the lake.

Underlying the layers of sedimentary rock are older metamorphic rocks, such as are exposed in Canada north of the sedimentary rock cover. A number of wells, drilled primarily for oil and gas exploration, confirm the existence of these metamorphic basement rocks, as well as the overlying sedimentary rock sequence.

Pleistocene and Recent Deposits Under Presque Isle State Park

There is little specific data on the material directly above the bedrock at Presque Isle State Park. Borings done by the Corps of Engineers just off the

lake shore of the Peninsula reveal up to about 20 feet of recent lake sand. Along the neck, this overlies up to about 25 feet of silt and clay also interpreted to be of recent age. From about Beach 4 east, the lowest material penetrated by the borings is dense, fine-to-coarse sand and gravel which the Corp's' reports described as glaciolacustrine sands. Depths of these borings ranged from 20.7 to 48.2 feet below lake level. Drilling on land, to install monitoring wells near the septic systems found only sand, gravel and some silt and clay to depths of approximately 35 feet. Drillers logs from two gas wells in the state park indicated "fire clay" and "gray clay" at depths of 37 and 62 feet, extending to top of bedrock at 114 and 117 feet. This has been interpreted as representing glacial diamict, but other interpretations are possible.

One of the features that may support the idea of the existence of glacial deposits under Presque Isle State Park is the Long Point-Erie ridge. This topographic high on the lake bottom is "broad, flat-topped, and about 40 km. (25 miles) wide" (1980 Corps' report) and has been interpreted as a glacial moraine. The Corps of Engineers (1979 report) determined that the ridge is topped by an average of 7 feet of sand and gravel; waves reworking a moraine may be the source of the material sampled. A SW-NE channel separates the ridge from the platform underlying Presque Isle State Park leaving room for doubt that the ridge once extended to the south shore and that glacial deposits underlie the spit.

1.3.3 Vegetation

Over the years, many different species of vegetation have been planted on Presque Isle State Park. In 1920, over 20,000 poplar trees were planted. Lombardy poplar was planted in the roadway medians which resulted in a short term distinctive feature of the state park. Records indicate that many cottonwood plantings have been made mostly for the exigencies of soil stabilization and aesthetic effects. In the 1950s or 60s, a cottonwood plantation was established in the Cookhouse Pavilion area. Other plantings include the Scotch pine plantation located along Pine Tree Road, and the introduction of Phragmites into the wetland areas. Some of these plantings, such as Phragmites, are now endangering rare plants in the state park.

In 1985, the forest types on Presque Isle State Park were mapped by the Pennsylvania Bureau of Forestry and the Pennsylvania Bureau of State Parks. Four forest types encompassing 1,392 acres are recognized on Presque Isle State Park. These forest types are the mixed oak, northern hardwoods, pine plantation, and cottonwood. Approximately 190 acres of the state park are in mixed oak type which consists of red oak, black oak, and red maple in the overstory. The northern hardwood type contains 204 acres with black cherry and red maple forming the overstory. The pine plantation contains approximately 92 acres with the dominant species being Scotch pine with scattered pitch pine and white pine. The remaining forested area of 690 acres consist of eastern cottonwood.

An effort to update plant species of special concern locations was initiated in 1980 by the Pennsylvania Department of Environmental Resources (PA DER) and Western Pennsylvania Conservancy (WPC) through the Pennsylvania Natural Diversity Inventory (PNDI) project. In 1985, field surveys were begun by PA DER, WPC, Presque Isle State Park Audubon Society, and Cleveland Museum of Natural History. This field inventory was continued through 1986 and 1987 by the Cleveland Museum of Natural History. The 1987 botanical survey included a natural community

classification description and mapping project (Bier, C.W. and J. Bissell, 1987). As a result of these inventories, exotic plant species invasion was identified as a threat to the natural integrity of Presque Isle State Park's native flora and natural communities. An exotic plant control project was initiated by the Bureau of Parks and Forestry, Division of Coastal Zone Management, and Cleveland Museum of Natural History (Bissel, 1989). Active management is being done by mechanical removal of nuisance species at selected sites.

The lake shore dunes along the north side of the peninsula are built and stabilized primarily by two species of grass: beach grass and switch grass. Cottonwoods naturally establish on the stabilized grass dunes.

Mature and young cottonwoods are a prominent component of the lower elevations of the ridge vegetation, the marsh/ridge transition areas, and where past filling operations created flat expanses. Cottonwood and willows are also aggressive invaders on exposed mineral sites adjacent to the areas of rapid sand accretion. Cottonwood is a short-lived species that has a remarkable ability when young to generate adventitious roots as sand accumulates above the initial and subsequent root collar(s). Eastern cottonwood, together with willows, is instrumental in helping to both create and stabilize dunes. In some instances, they may be replaced by red maples, black oak, or black cherry. But in other areas, their impending loss may leave only low, semi-shrubby cover and it will be an extended period of time before other more tolerant trees attain present canopy levels.

The old fields and savannahs encompass 39 acres on Presque Isle State Park. Old fields consist primarily of bayberry, Indian grass, and various species of goldenrod. The savannahs are dominated by Indian grass, little bluestem, and switch grass.

The wetlands of Presque Isle State Park are a highly complex, extremely vulnerable system and are some of the best and most extensive wetlands in Pennsylvania. They are invaluable as a habitat for waterfowl and other wildlife, a support for fisheries, and sanctuary for rare and endangered species; and an asset for their educational, recreational and aesthetic values. Wetlands comprise 458 acres on Presque Isle State Park. The major species found in the wooded swamps are blackgum and red maple. The shrub swamps are dominanted by buttonbush. The marshes and wet meadows are characterized by sedges, cattails, bur-reed, phragmites, spatterdock, and fragrant white lily.

1.3.4 Water

Lake Erie Water Levels

The water level of Lake Erie at any point in time depends on a balance of the amount of water received from the amount of water removed by a variety of means. If these quantities are in exact balance, the general lake level is constant. If the quantities received are greater then the quantities removed, the volume of water in the lake increases and the lake level rises and, in the absence of any controls, the outflow increases. The amount of change depends on the magnitude of changes in water supply and the timing of the passage of this supply through the system. Changes in water supply and the timing of its flow are the result of the interaction of the natural and artificial factors which affect the supply and discharge of water to and from the system. The range of levels and flows is also directly affected by the

relationship between the area of the lake and the discharge capacity of its major outlet(s).

There are three categories of water level fluctuations that should be understood with respect to observed levels on Lake Erie. Each of these categories produces an affect with respect to Presque Isle State Park. The three categories are: long-term, seasonal, and short period.

Long-term fluctuations are the result of conditions within the hydrologic cycle over an extended period of time. Hydrologic imbalances that result in a low water supply produces low levels such as were recorded on Lake Erie in the mid-60s. Those imbalances that produce a high water supply produce high levels such as were recorded in 1973 and again in 1985. In examining the period of record (1860-1994), no case can be made for regular, predictable cycles in water levels. Intervals between episodes of high and low levels and the duration of any episode vary widely for the 125 year period. The range between extremes of high and low are in the magnitude of 5.3 feet (1.8m).

Seasonal fluctuations in water level are superimposed on the long-term changes and are based on the normal annual hydrologic cycle. These seasonal variations are predictable in the sense that higher net supplies can be expected in the spring and early summer with lower net supplies during the remainder of the year. With one possible exception, the high water level for Lake Erie has always been recorded by late July. In most instances the high level comes at the end of May and persists through June and early July. These variations are normally small, averaging about 1.5 feet (.46 m) on Lake Erie.

Short-period fluctuations can last from a few hours to several days and are caused by meteorological disturbances. Wind and difference in barometric pressure over the surface of a lake can create some significant changes in levels without changing the overall volume of water in the lake. During such an event winds blowing from the WNW over the long fetch of Lake Erie can produce simultaneous readings at the eastern and western ends of the lake that can vary as much as 8 feet (2.44m).

The Formation of Presque Isle State Park Ponds and Lagoons

The ponds, lagoons and wetlands of Presque Isle State Park are a highly complex, extremely vulnerable system. They are invaluable as a habitat for waterfowl and other wildlife, a support for fisheries, a sanctuary for rare and endangered species, and an asset for their educational, recreational and aesthetic value.

Presque Isle State Park is a unique recurving sandspit-formed peninsula. Erosion of sand at the western neck of the peninsula is redeposited at the far eastern end of the peninsula. The repeated breaching of the neck and the development of the Isle's northeast extension constantly caused new bars to form eventually touching the land mass and trapping lake waters forming beach or sandspit ponds.

The ponds that develop along the lake side are always elongated and parallel to the present or former shoreline, and initially only a few meters from the lake. The ponds may persist for a few months or for several hundred years old. Beach ponds that are sealed in formation, have no direct lake contact. These ponds are shallow and narrowly elongated. As the pond ages, its volume and surface area are reduced as the perimeter is filled in by

windblown sand and organic matter accumulated through the death and decay of organisms.

Another type of pond formation that occurs on Presque Isle State Park Peninsula are lagoon ponds. These ponds are formed when sand, eroded from the lakeside moves eastward and is deposited at the northeast end. Occasional strong wave action carries sand around the eastern tip creating a recurved beach which isolates a fingerlike pool from the main body of the lake. Lagoon ponds may retain contact with the lake for a number of years.

Groundwater on Presque Isle State Park

Groundwater is water which occurs in the subsurface in space between solid materials. In the case of Presque Isle State Park, which is predominately sand, 25 to 50 percent of the total volume can be occupied by groundwater.

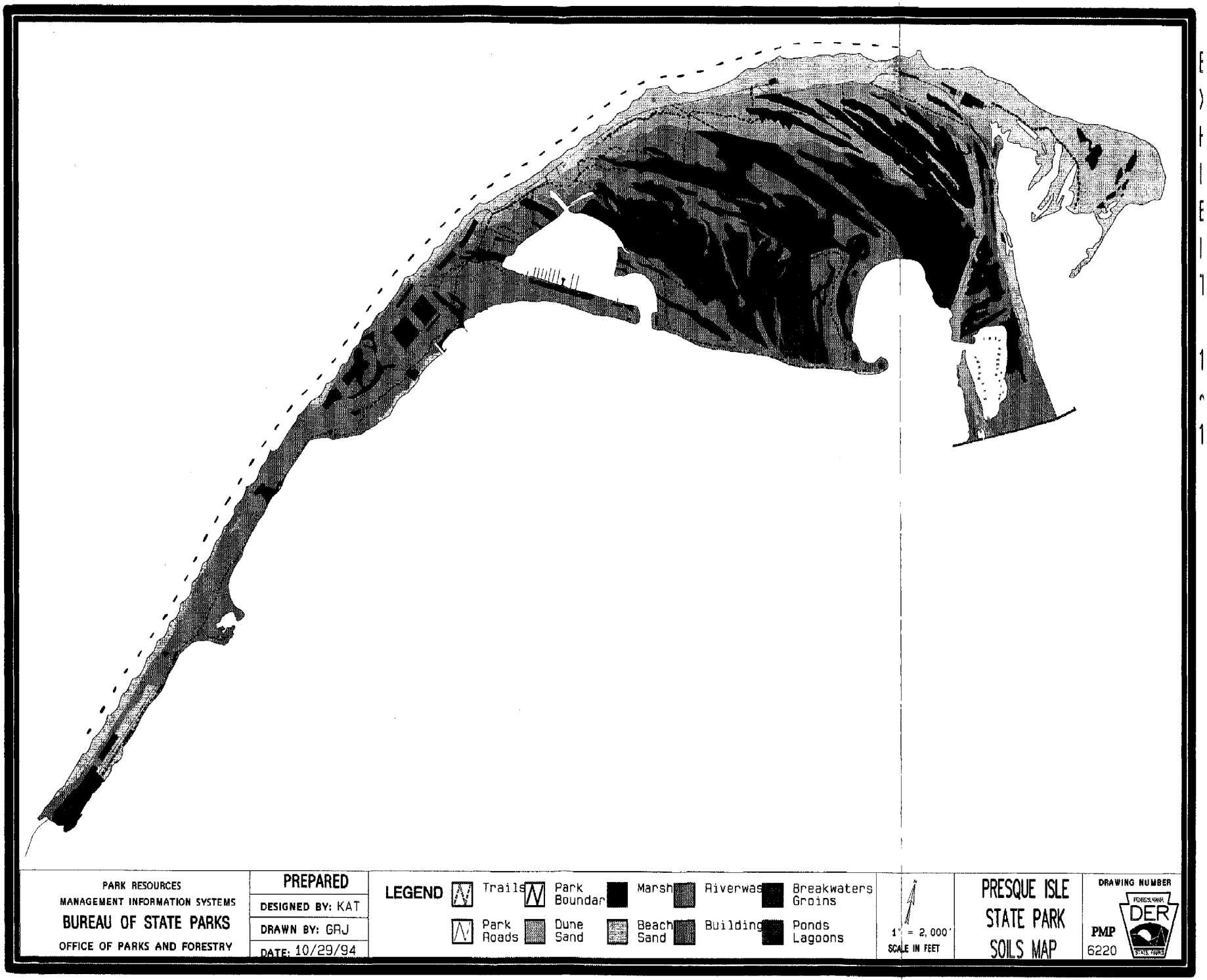
The water table, which is the upper surface of water saturation, is very shallow on Presque Isle State Park. Below the water table, all space between solid materials is occupied by water. In general, the water table has the same (or slightly higher) elevation as the surface of the lake. During the wet periods, the water table on Presque Isle State Park rises. During dry periods, the water table is lower; approximating lake level. The time it takes for a "higher" water table to readjust itself to lake level is proportional to the time it takes for water to move through the sand. The loose, unconsolidated sand which comprises Presque Isle State Park is very permeable, allowing water to move through the material relatively easily. In an undisturbed state though, groundwater movement is slow (zero to a few feet per day) because of the level conditions. Like surface water, groundwater requires a slope in order to flow. As slope increases, flow rate increases. The high permeability of the sand, and hydrostatic pressure exerted by the surrounding lake, prohibits the water table from falling significantly below lake level. This situation provides a very stable supply of groundwater. However, the permeable conditions allows for rapid changes in groundwater quality.

1.3.5 Soils

The four soil types which occur in the state park are all "new" soils which are currently in the process of formation and change. Caution needs to be exercised due to their fragility and in selecting species to be planted due to the lack of soil nutrients and drought-prone characteristics of these soils. A soil map of Presque Isle State Park is included in this report, Exhibit 1-1.

Beach and Riverwash (Ba) is a miscellaneous land type is made up of unassorted sand, gravel, and small fragments of flagstone. Before sediments are deposited on the beach, they are transported by streams and are then dropped into the waters of the lake. Here, they are reworked by wave action and are then washed onto the beach. During storms the beach material is again reworked and is carried eastward by shore currents. In its place new sediments are deposited by waves. During the winter a well-defined beach is often altered greatly by storms.

Beach and riverwash is not stable enough to maintain a cover of plants. It consists largely of material weathered from the underlying shale; it also includes some sediments of sandstone, granite, and quartzite that were carried into the area by glaciers. No soil profile has developed.


PARK RESOURCES
MANAGEMENT INFORMATION SYSTEMS
BUREAU OF STATE PARKS
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DESIGNED BY: KAT
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DATE: 10/29/94
LEGEND
Trails
Park Boundar
Marsh
Riverwas
Breakwaters Groins
Park Roads
Dune Sand
Beach Sand
Building
Ponds Lagoons
1" = 2,000'
SCALE IN FEET
PRESQUE ISLE STATE PARK SOILS MAP
DRAWING NUMBER
PMP
6220
DER

This land type has no value for agriculture, but it provides valuable areas for recreation.

Beach Sand, Stabilized (Bb) is a miscellaneous land type consists of deep, sandy beach material that is nearly level and moderately well-drained to poorly drained. This material is mostly acidic with the exception of the moist sandplains at Budney Beach which has alkaline characteristics. It is protected by a beach ridge from the waves of Lake Erie. The material has been in place long enough so that it has a cover of plants but not long enough for a soil profile to form. It does, however, have an organic surface layer. No erosion has taken place.

This extensive land type occurs only on Presque Isle State Park. The vegetation consists primarily of cottonwood, bayberry, and several important grasses - Indiangrass, switchgrass, and little bluestem. The seeds of these grasses apparently were brought to Presque Isle State Park by the lake current.

This miscellaneous land type formerly consisted of shifting sand. The sand became stabilized after a ridge was built up that protected it from wave action. The beach sand is only 1 to 1½ feet above the level of the lake. The permanent water table, therefore, is only about that depth below the surface. The beach sand is low in plant nutrients but the groundwater has minerals and nitrogen in solution. These plant nutrients, along with the favorable permeability of the material and the stable supply of moisture, cause plants to make a dense growth.

This land type has little agricultural value. It is suitable for recreational use and is also suitable for trees or for wildlife habitats.

Dune Sand (Ds) is a miscellaneous land type consists of deep, loose, droughty, windblown sands. The sands were sorted from the lacustrine materials by wind and were blown into the shape of dunes. These dunes were built primarily by beach grass and switch grass. The dunes lack the characteristic crescent or oblong shape of active dunes because they have been partially stabilized by little bluestem, switchgrass, and cinquefoil.

Fresh Water Marsh (Fm) is a land type that occurs in shallow lagoons on the bay side of Presque Isle State Park. The soil material consists of 6 to 12 inches of partly decomposed organic material that is underlain by deep lacustrine sand and gravel. The surface is covered by 1 to 3 feet of water. The water level fluctuates seasonally and is especially high following storms.

The areas support a luxuriant growth of sedges and are suitable as habitats for wildlife. In general, most of the Presque Isle State Park marshes are sedge marshes, and the sedge marshes support many plants of special concern. The growth of cattails in many of the marshes is associated with disturbance and the cattail growth may well be a long term threat to the sedge marshes in the state park.

1.3.6 Minerals

Oil and Gas

A number of gas producing zones exist within the upper 1,000 feet of bedrock, which consists of shales, siltsones, and very fine sandstone. Production from this zone is usually sufficient for domestic or light

commercial use. Production life from this shallow zone varies substantially, ranging from 1 year or less to as much as 20 years.

The major commercial gas producing geologic formations in Erie County are the Oriskany Sandstone and Medina Group sands, which occur at a depth of approximately 1,300 feet and 2,100 feet respectively beneath Presque Isle State Park. The Oriskany is very erratic in occurrence and has not been proven to exist beneath the peninsula. Gas or oil production from deeper geologic formations has not been evaluated to date.

There are two gas wells located in the state park. The Marina well drilling (permit number ERI-20846) was completed on October 10, 1979, at a depth of 1,276 feet. It was estimated to heat several buildings (marina, manager's home, and administration building) for 30 to 40 years. PA DER provided $23,000 towards the $200,000 project. The well proved to be a disappointment producing only 4,000 cubic feet per day in the first year.

The Beach 7 well was drilled in 1910 by the City of Erie at a depth of 3,572 feet. It was used to run machinery at waterworks park and later abandoned in the 1920s. The marina gas well is currently used to heat the administration building garage, maintenance building, carpenter shop, and the marina comfort station.

In 1970, a black, foul-smelling surface discharge was reported in the Beach 7 well area. The discharge resulted in the release of hydrogen sulfide gas into the air and other hazardous substances into the soil and shallow ground water near the well. As the odors continued, DER uncovered the pavement overlying the discharge in 1979, and identified the well as the source of the discharge. The discharge was found to be emanating from a deep underground formation called the Bass Island formation.

From 1964 to 1971, over one-billion, ninety-million gallons of wood pulping wastes were injected into the Bass Island formation by the Hammermill Paper Company at wells located approximately four miles to the east of the Presque Isle State Park 7 well. An explanation is that the injected wood pulping wastes flowed along the Bass Island formation and surfaced at the Beach 7 well. Beach 7 well was shut off and plugged in April 15, 1980 to 900 feet of the surface. At that time a substantial amount of gas was found near the surface that did have potential for use.

In September 1983, the Beach 7 well was placed on EPA's National Priorities List. The National Priorities List consists of hazardous sites across the country where cleanup needs are so serious as to warrant designation as a Superfund site. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as the "Superfund," was passed by Congress in 1980. The Act addresses the nationwide problem of uncontrolled hazardous sites.

In 1992, EPA delisted the well from the National Priorities List. Restoration work was done on the site.

Iron

Iron ore was mined in the 1800s at the bluffs at the neck of the peninsula.

1.3.7 Fish and Wildlife

There are over 22 species of mammals, 30 species of "herptiles", over 780 species of invertebrates, 17 species of fish, and a minimum of 321 bird species which have been found at Presque Isle State Park.

Fish

The fish community inhabiting Lake Erie, Presque Isle Bay, and tributary streams is diverse and unlike that found in any other part of Pennsylvania. Lake Erie has at least 17 species of fish involved in the sport fishery and about 15 species in the commercial harvest. Presque Isle Bay supports a warm water fishery, while Lake Erie supports both a cold and warm water fishery. Lake Erie provides an opportunity for anglers to catch coho and chinook salmon, and steelhead trout. It is one of the few waterways inhabited by lake trout, rainbow smelt, bowfin, longnose and spotted gar, and freshwater drum. In addition to these species there are at least 86 other species of fish known to occur in these waters. Most of these species will reproduce in the waters of Lake Erie and its tributaries. In some tributaries natural reproduction of trout has been noted. All but the smallest tributaries sustain spawning runs of coho, chinook salmon, and steelhead and rainbow trout. Smallmouth bass, white suckers, smelt, and emerald shiners also use the mouth of the largest streams as nursery areas or spawning grounds. Reproduction of muskellunge has not yet been documented.

Invertebrates

Presque Isle State Park has a spectacular series of habitats laid out in chronological sequence from a few months to hundreds of years in age. The peninsula is in continual transition and several collectors have noted that Presque Isle State Park has the most diverse population of faunal species in the northeastern United States. The geographic location of Presque Isle State Park is such that it is on the border for southern extension of the northern range of species and northern extension of the southern range of species. There are over 780 invertebrate species representing 7 phyla recorded for Presque Isle State Park. Many invertebrates are near the bottom of the food chain and are necessary for the whole ecosystem to exist and an understanding of the various phyla may provide an understanding of the changing pond conditions on Presque Isle State Park. There is evidence of a decrease in certain insect populations notably of the order Odonata over the past 30 years. Lepidopterists have noted color variant of butterflies on Presque Isle State Park. A list of invertebrates was compiled by Masteller (1986) in a comprehensive literature search and field work.

Zebra Mussels

The exotic zebra mussel (Dreissena polymorpla) is present in Lake Erie and was first observed at Presque Isle in 1990. The explosions in numbers of this mussel has caused problems with man-made structures and native mollusc. The windrow effect on the beaches of washed up shells from dead zebra mussels may require some maintenance efforts. There are no control measures other than educating the users to the presence of zebra mussels and the need to avoid transporting the mussels to unaffected waters.

Amphibians and Reptiles

Of the 30 species of herpetofauna present or expected to be present on Presque Isle State Park, McPherson captured or observed 19 of these species in a study conducted in late summer of 1982. McPherson's study showed that frogs and toads form the largest populations of amphibians in the state park. Only a few species of salamanders were observed or captured during the study with the red spotted newt being the most common. Four species of snakes were observed in the state park. The two most common species of snakes were the northern brown snake (Storeria d. dekayi) and the eastern garter snake (Thamnophis s. sirtalis). Nine species of turtles have been recorded for the peninsula, but only 5 species were observed during the 1982 study. The midland painted turtle was the most abundant turtle found on Presque Isle State Park.

Wildlife

A complex of physical and biological factors determine the occurrence of a specific plant community in an area. In turn, many species of wildlife require a specific type of plant community or association of specific plant communities to thrive. Because of the diversity of physical and biological factors found at Presque Isle State Park, there are many different species of wildlife inhabiting the state park.

The 1934-35 Erie County survey, dealt specifically with Presque Isle State Park. From this data, in addition to what is known about individual species range and habitat preferences, it is estimated that Presque Isle State Park may be the home to as many as 48 different species representing 7 taxonomic orders. Only 22 species have actually been verified for Presque Isle State Park.

Because of the peninsula's geographic location and the diversity of natural habitats which occur there, Presque Isle State Park is a haven for birdlife. It is important both as a resting and feeding area for multitudes of migrants and as a nesting area for many species, including several important species of special concern. A minimum of 321 species of birds have been recorded on Presque Isle State Park. At least 45 of these are officially listed as species of special concern: 6 are state or federally endangered, and 6 are listed as threatened. Two federally endangered species -- the bald eagle and the piping plover -- nested on the peninsula as late as the mid-1950s.

Deer were artificially stocked on Presque Isle State Park during the 1950s. At that time 40 deer were placed on the peninsula. They thrived, their population exploded, and all reachable portions of palatable species of vegetation were heavily browsed. Supplemental feeding by area residents avoided some starvation but it tamed many animals. Consequently, when the Pennsylvania Game Commission (PGC) reduced the population, there was a huge public outcry.

The population built back up again and reached the point in the early 1970s where starvation was in evidence despite supplemental feeding. At that time the population was estimated at between 200 and 300 deer. Fifty carcasses were found in the winter of 1974, and the Pennsylvania Game Commission began a public relations effort to advise the public that the deer suffered from overprotection. Citizens were led on a hike to see first-hand the poor conditions of the live animals and the number of frozen carcasses that existed.

In 1975, Pennsylvania Game Commission personnel conducted a trap and transfer program with public acclaim instead of criticism. That favorable public opinion held in spite of a loss of approximately 30% of the animals, primarily weakened yearlings and doe. The Pennsylvania Game Commission reduced the herd in 1975 from more than 200 deer to 75 by the use of anesthetizing darts and the transport of the immobilized animals to other state game lands in northwestern Pennsylvania.

An annual aerial deer survey was initiated in 1980 to monitor deer populations on Presque Isle State Park.

Red fox are known to be breeding successfully on Presque Isle State Park. This is documented by numerous observations by state park and Pennsylvania Game Commission personnel and others. There are no formal population studies to document specific total numbers or trends. Fox populations can be cyclically affected by diseases.

Raccoons are commonly observed on Presque Isle State Park. While the state park's raccoon population is subject to normal fluctuations in the population levels, the numbers of raccoons appear to stay consistently high. This is primarily caused by the availability of garbage, artificial feeding, and protection from natural enemies. As documented by the McPherson (1982) study conducted on Presque Isle State Park, turtle egg predation by raccoons occurs in inordinate amounts with possible predation on snake and bird eggs.

A population of beavers is present in the state park. Their presence adds to the diversity of wildlife. However, beaver activity in developed use areas pose problems with fallen trees. Control measures may be implemented to regulate the number of beavers in use areas.

1.3.8 Species of Special Concern

Birds

There are 35 birds listed as Pennsylvania species of special concern in 1994. Of these, the bald eagle, piping plover, and peregrine falcon are listed as federal endangered. The bald eagle and the piping plover nested on the peninsula as late as the mid-1950s.

At least 10 species of special concern rely upon wetland habitat, and at least 21 species of special concern rely upon woodlands and/or edges with at least 5 of these relying upon dead trees within or on the edge of woodland habitats. At least 17 species of special concern rely upon open sandy beaches and/or open grasslands, and the remaining species of special concern (breeding, former breeding, visitor, or migrant) rely upon a variety of habitats including open water. Some species, such as the bald eagle, require large undisturbed areas for nesting and feeding.

Fish

There are 8 fish species listed as Pennsylvania species of special concern found within the Presque Isle Bay and peninsula waters. The mooneye is listed as Pennsylvania extirpated, however, two specimens have been captured and verified by anglers in Presque Isle Bay. These records may be doubtful. The species persists either in Presque Isle State Park or, more likely, has penetrated the eastern basin as transients from western Lake Erie.

The blue pike is listed as extinct. The lake sturgeon is listed as Pennsylvania endangered. Young specimens are occasionally reported in Presque Isle Bay by anglers and adult specimens have been reported caught and released by commercial fishermen in Lake Erie. The Lake Erie Research Unit of the Pennsylvania Fish and Boat Commission measured a 179 centimeters total length (aged 40+ years by fin ray section) specimen which was washed ashore at North East, Pennsylvania in 1975. The most recent specimen was observed 1991.

The eastern sand darter is listed as Pennsylvania threatened. The species has a reproducing population along the shores of eastern Lake Erie and most probably near or within Presque Isle State Park, although its numbers must be greatly diminished. In 1975, a specimen was collected inside of the bay near the tip of the peninsula, and in Horseshoe Pond in September 1990.

There are 4 species listed as Status Indeterminate: Iowa darter, silver chub, lake herring, and the lake whitefish. The Iowa darter is a glacial relic that is now limited to only two other locations in Pennsylvania outside of Presque Isle State Park. Because of this and its restricted habitat requirements, it is felt the species is very sensitive to habitat deterioration and vulnerable to extirpation in its Pennsylvania range. The Iowa darter is believed to be limited at Presque Isle State Park to the south shore but has also been found in the lagoon across from Misery Bay near the boat livery. Cooper, 1985 (Species of Special Concern) indicates that the species is "locally common." Any threat to its habitat in this ecological reserve of Presque Isle State would probably weaken the vitality of this isolated population, and species in Pennsylvania. The silver chub is listed as Status Indeterminate by the Pennsylvania Fish and Boat Commission although it is considered to be threatened. The silver chub has been reported caught annually in the U.S. Fish and Wildlife Service population assessment exercises in the western basin of Lake Erie. Only one specimen has been reported since 1971 in eastern Lake Erie. Since 1971, a single specimen of lake herring has been captured by the Pennsylvania Fish and Boat Commission in Pennsylvania waters of Lake Erie. Isolated occurrences along the beaches of Presque Isle State Park are possible in the fall and winter. The lake herring prefers cool temperatures and deep water, and consequently is not a likely inhabitant of Presque Isle Bay or peninsula waters. The Pennsylvania Fish and Boat Commission has been able to document reproduction of the lake whitefish annually since 1971. Whitefish year classes vary considerably in size, and there are still at least 10 or more age groups in the Lake Erie population, and the limited commercial catch seems to have a minimal effect on stock size. The species contact with Presque Isle State Park is limited to casual excursions from its deep water habitat in spring and fall. Because its numbers are but a fraction of its abundance in the first half of this century, the species status remains undetermined. The occasional large year class, e.g. 1985, seems to suggest possible rehabilitation to higher levels of abundance.

Other species of concern include the spotted gar and the bowfin, both are considered rare. The spotted gar is still found in trapnet surveys and other Presque Isle Bay and peninsula water fish collection exercises. Presque Isle Bay and peninsula habitats are the only areas of the spotted gar's Pennsylvania distribution. The bowfin population at Presque Isle State Park appears to be one of the self-substaining ones which thrives in its original Pennsylvania range. The bowfin is unique among North American fish because it is the sole representative of the order Amiiformes.

Invertebrates

Minimal information exists for Presque Isle State Park invertebrates. There are 4 insect species, and 8 species of mollusk listed as Pennsylvania species of special concern known from Presque Isle State Park.

There are 7 species of invertebrates that may or may not be present on Presque Isle State Park because of elimination of their habitats. They are the silver spotted skipper (Eparyureus clarus), the roadside skipper (Amblyscirtes vialis), pepper and salt skipper (Amblyscirtes hegon), regal frillilary (Speyeria idalia), zebra swallowtail (Eurytides marcellus), and the West Virginia white (Artogeia virginiensis). A list of the species of special concern and their Pennsylvania status is located in the Appendix.

Amphibians and Reptiles

There are two known "herptiles" species listed as Pennsylvania species of special concern in 1986 and no known amphibians or reptiles listed on the Federal Species List. The Blandings' turtle is listed as Pennsylvania Endangered, and the eastern hoghnose snake is listed as Status Indeterminate.

Mammals

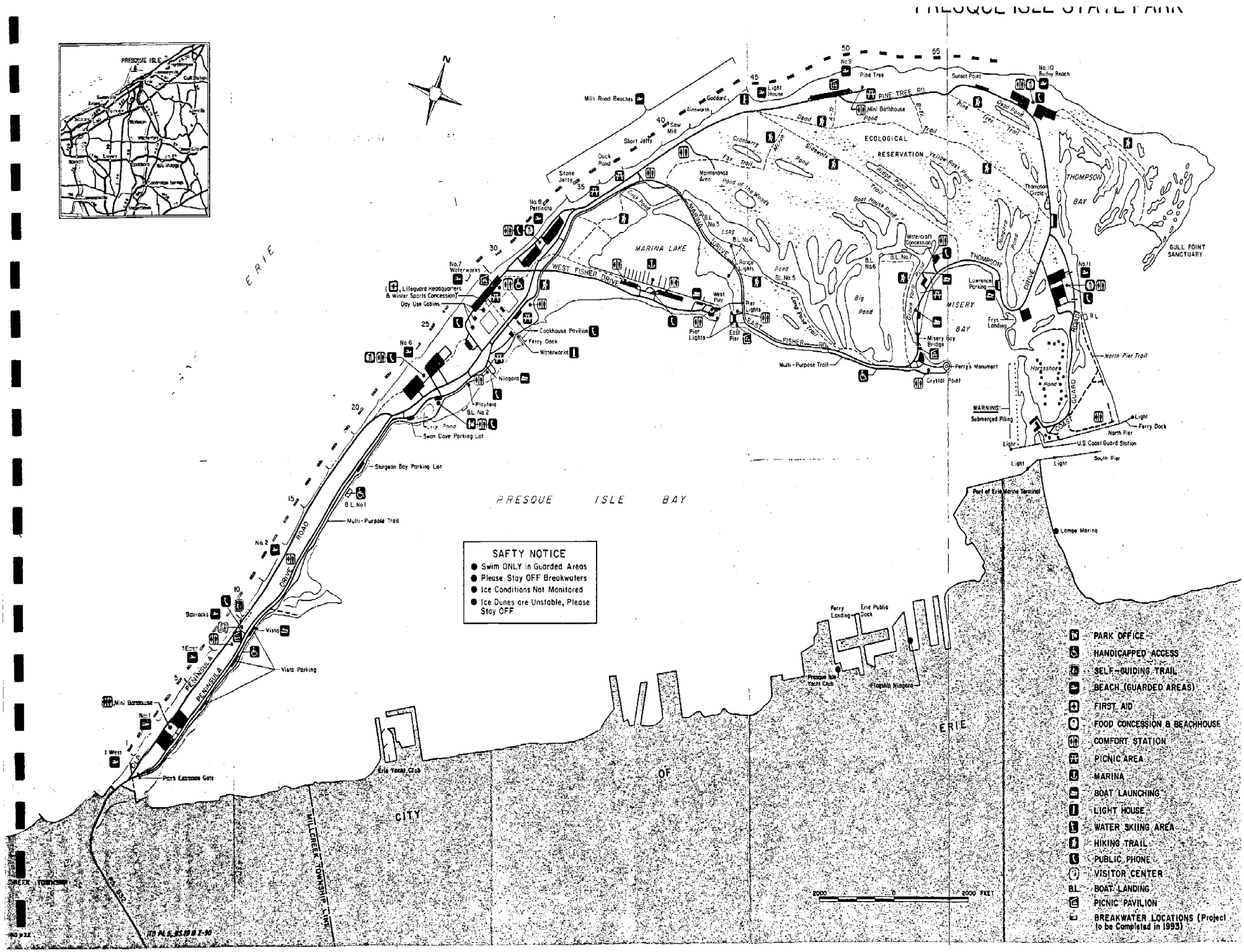
At this time there are no known mammals at Presque Isle State Park currently listed as federal or Pennsylvania species of special concern. However, Keen's little brown bat (Myotis keenii) has been found not far from the pennisula in Millcreek Township and is listed as Pennsylvania vulnerable. The prairie deer mouse (Peromyscus maniculatus bairdii), is a species of special local concern which was collected quite commonly along the beach at the eastern end of the peninsula as late as 1959. Collections made in recent years throughout the county have not yielded any specimens of this mouse.

1.4 Recreation Facilities

Presque Isle State Park, located in Pennsylvania's northwestern corner on the south shore of Lake Erie, is unique in many aspects. It is extremely diverse in its physical make-up and thus its usage. Presque Isle State Park or "the Peninsula" as it is commonly referred to, is many things to many people (Exhibit 1-2). Exhibit is the map being currently used and will be replaced with the new base map at the conclusion of Phase II of this project.

Presque Isle State Park's usage is most concentrated during the period of late June, July, and August. Swimming/sunbathing is overwhelmingly the most prevalent activity, accounting for approximately 75% of all visitor recreation during this time. Many of these visitors are from out-of-town and contribute significantly to the tourism industry in Erie. By comparison, all other recreational and educational activities appear to have light participation.

The recreational opportunities include picnicking at one of 825 tables, boating using both non-powered and powered craft, water skiing, fishing, limited hunting, hiking, ice fishing, cross-country skiing, bicycling, roller blading, and environmental education opportunities. In conjunction with boating the state park provides six launch ramps, 498 slip marinas, and boat rentals which include canoes, row boats, and motorboats.


PRESQUE ISLE STATE PARK
PRESQUE ISLE BAY
ERIE
MARINA LAKE
MISERY BAY
THOMPSON BAY
ECOLOGICAL RESERVATION
PINE TREE RD
WEST FISHER DRIVE
EAST FISHER ROAD
PENINSULA DRIVE
MILLCREEK TOWNSHIP LINE
CITY OF ERIE
GULL POINT SANCTUARY
SAFTY NOTICE
Swim ONLY in Guarded Areas
Please Stay OFF Breakwaters
Ice Conditions Not Monitored
Ice Dunes are Unstable, Please Stay OFF
PARK OFFICE
HANDICAPPED ACCESS
SELF-GUIDING TRAIL
BEACH (GUARDED AREAS)
FIRST AID
FOOD CONCESSION & BEACHHOUSE
COMFORT STATION
PICNIC AREA
MARINA
BOAT LAUNCHING
LIGHT HOUSE
WATER SKIING AREA
HIKING TRAIL
PUBLIC PHONE
VISITOR CENTER
BOAT LANDING
PICNIC PAVILION
BREAKWATER LOCATIONS (Project to be Completed in 1993)
2000 0 2000 FEET

A large percentage of the state park visitors come year-round to drive their cars on the peninsula and view the flora and fauna. These are mostly local residents who see the state park as their "country" environment. For the naturalist, the quality of their experiences on Presque Isle State Park rate high among those who come to study and enjoy the ecological environment so unique to this sandspit.

1.5 Historical Sites/Structures

Presque Isle State Park possesses several types of resources which make it unique within the state park system. Among these are the large number of sites with archaeological potential dating from the periods of French, British, and American military occupation (1753-1825). Of further significance are those buildings and structures which pre-date the Civilian Conservation Corp (CCC) era (1933-42) during which the vast majority of state park facilities were constructed. While several of these were built by the City of Erie for what came to be known as "Pumphouse Park," they are now owned by the Commonwealth.

There are a total of 30 historic buildings/structures/sites (Exhibit 1-3) which have been documented for Presque Isle State Park. One of the historic buildings is the Presque Isle State Park Lighthouse, which has been listed in the National Register of Historic Places under a nomination submitted by the Historic American Engineering Record Great Lakes Lighthouse Survey in 1979.

The following table presents a summary of the Pennsylvania Historical and Museum Commission's Historic Resource Survey Forms which are located in the Appendix:

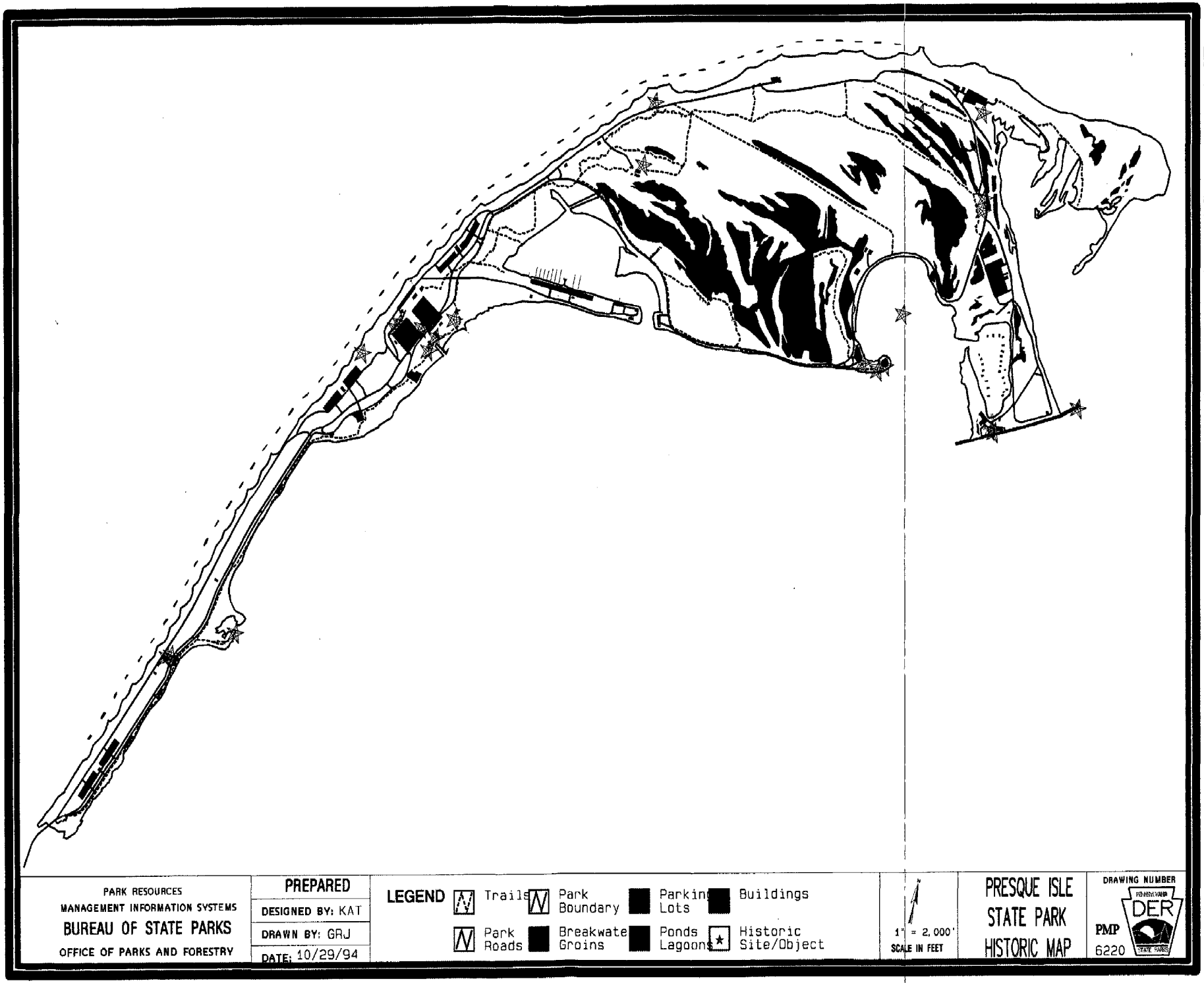
1. Fog Signal Station, ca. 1899.
2. Single Dwelling, ca. 1870. Lighthouse Establishment.
3. Double Dwelling, ca. 1900. Lighthouse Establishment.
4. Pierhead Light, ca. 1819. Lighthouse Establishment.
5. Leo's Boat Livery. 1938.
6. "French Stone Chimney," ca. 1753.
7. British Post, 1760.
8. Crystal Point Blockhouse, 1813.
9. French Blockhouse, ca. 1758.
10. Caviar Factory, ca. 1874.
11. Fire Tower, ca. 1928.
12. Biological Field Laboratory, ca. 1930.
13. "Waterworks" Sawmill, ca. 1921.
14. Thompson Monument, ca. 1931. Park & Harbor Commission.
15. Misery Bay, ca. 1753-1945.
16. Nature Center, "English Cottage" style, ca. 1937.
17. Pumphouse, ca. 1917.
18. Smokehouse Pavilion, ca. 1920. (Cookhouse).
19. Manager's Residence, Former Summer House, ca. 1903.
20. Presque Isle State Park Lighthouse, ca. 1872.

21.- 29. Nine Miscellaneous State Park Buildings, ca. 1930.

30. Perry Monument, ca. 1926.

Presque Isle State Park contains a large area of potentially sensitivity (Exhibit 1-4) in regards to archaeological.

EXHIBIT 1 ~ 3



PARK RESOURCES
MANAGEMENT INFORMATION SYSTEMS
BUREAU OF STATE PARKS
OFFICE OF PARKS AND FORESTRY

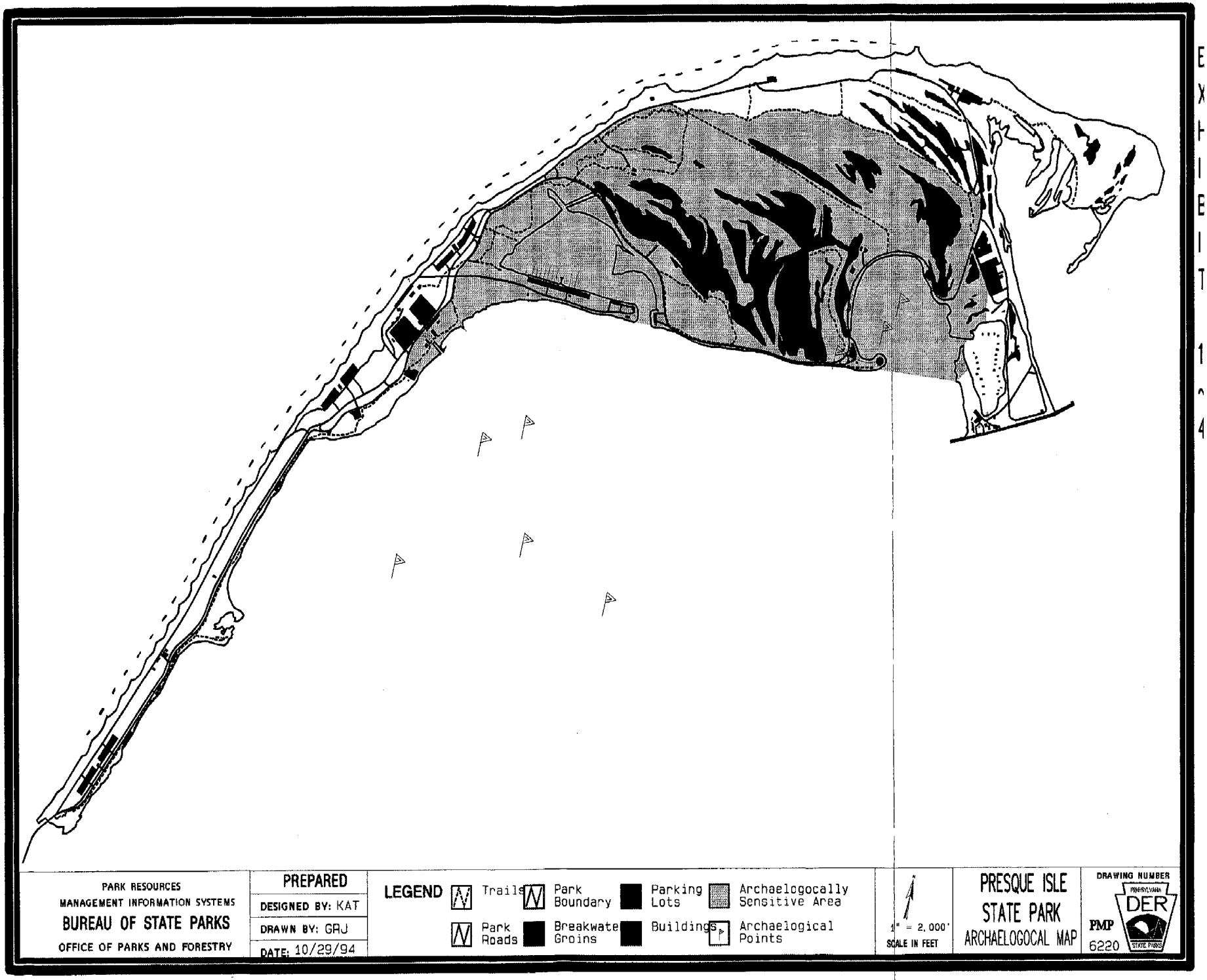
PREPARED
DESIGNED BY: KAT
DRAWN BY: GRJ
DATE: 10/29/94

LEGEND
Trails
Park Boundary
Parking Lots
Buildings
Park Roads
Breakwater Groins
Ponds Lagoons
Historic Site/Object

1" = 2,000'
SCALE IN FEET

PRESQUE ISLE STATE PARK HISTORIC MAP

DRAWING NUMBER
PMP
6220



PARK RESOURCES
MANAGEMENT INFORMATION SYSTEMS
BUREAU OF STATE PARKS
OFFICE OF PARKS AND FORESTRY

PREPARED
DESIGNED BY: KAT
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LEGEND

- Trails
- Park Boundary
- Parking Lots
- Archaelogocally Sensitive Area
- Park Roads
- Breakwate Groins
- Buildings
- Archaelogical Points

1" = 2,000'
SCALE IN FEET

PRESQUE ISLE STATE PARK
ARCHAELOGOCAL MAP

DRAWING NUMBER
PMP
6220

DER
PENNSYLVANIA
STATE PARKS

EXHIBIT 12-4

1.6 Shoreline Processes

Presque Isle State Park is a compound recurved sand spit that is migrating to the NNE at an indefinite rate. The origin of Presque Isle State Park is related to a supply of sand and gravels deposited by receding glaciers 10,000 years ago and a lake level that has varied through a hundred feet or more since that time. This supply of sediment has rotated off a clay and bedrock platform that exists to the west of Presque Isle State Park between the current position of the neck and Walnut Creek.

The leading edge of the migrating spit (Gull Point) is spilling sand carried the length of the spit into deeper waters. The platform that supports Presque Isle State Park does not extend to the east. Therefore it is unlikely that Presque Isle State Park will migrate as a spit form any further down the coast. In fact, if left unprotected, Presque Isle State Park would evolve into a "flying spit" and eventually disappear into the deeper waters of the eastern basin of Lake Erie. The apparent "growth" of Gull Point at the distal end of the spit is attributable mainly to a large amount of sand moving down the face of the spit in the late 1920s. This "slug" of sand was available as a result of severe storms and rising lake levels eroding beaches that had accumulated sediment during the quieter times preceding 1925. Gull Point has grown appreciably since 1955. The Army Corps of Engineers nourished the beaches in 1955-56 with four million cubic yards of very fine sand which eroded to the distal end within months of being deposited.

Presque Isle State Park is, as a landform type, an old age geomorphic feature that has evolved over time under conditions that are in constant change. The fact that it is migrating with a net annual loss to its existing form is an indication of advancing age. In the case of Presque Isle State Park, such rejuvenation, a sustained increase in the amount of sediment available for growth and/or a significant decrease in the water level of Lake Erie would rejuvenate Presque Isle State Park.

1.6.1 Sand Spit Morphology

Sand spits develop when littoral drift plays a predominate role in the system, provided the drifting sediment enters a zone of slack water where deposition can occur. Littoral drift is a current that operates along the shore. This current carries sediment deposited as material eroded from updrift. At Presque Isle State Park this littoral drift system generally operates in a southwest to northeast direction.

When there is, in the shore region, a surplus of unconsolidated sediment, the prevailing currents sweeping the shore (littoral) will carry this sediment along the shore. This longshore transport system effectively distributed sand and gravel along the coast. The eroding shore and streams carrying sediment add to the overall supply along any given reach of shoreline. As long as sediment is in surplus of the demands of the offshore losses, beaches will persist along the coast.

Spits form when this moving body of sand enters a zone of slack water; across the mouth of a bay for example. Or, the spit may form as sediment is carried lakeward from a headland or an irregular coast. Simple spits build very quickly in the initial stages because of the shallowness of the nearshore water. As the spit builds into deeper water, the growth rate diminishes as more material is needed to provide an ever enlarging base for the above water accumulation. Incoming waves then have an opportunity to operate at the growing (distal) end of the spit turning it toward the shoreline behind the spit. Such a spit takes on a hooked form and is called a hooked, or recurved, sand spit.

The overall system supplying material to the littoral drift is not uniform. Coastal erosion and supplies of sediment from streams are intermittent in character. So it is that when forces tending to elongate the spit in a more or less straight line prevail, the spit builds lakeward. Later, a period of time may elapse during which the turning forces prevail. These forces, mostly waves, cause the otherwise linear form to deflect shoreward. A spit is produced whose inner side is marked by a series of deflected points representing this sequence of events. A radical recurvature may begin to enclose open water producing bays or, close off open waters entirely producing ponds (lagoons). Such ponds then evolve more or less independently of the open lake and are the heart of the emerging spit ecosystem. Such spits are termed compound recurved sand spits.

As the shore feeding the spit erodes, the landward (proximal) end of the spit recedes with the eroding shoreline. The spit takes on a form where the proximal end is narrow, expanding into the fuller spit form at the distal end. This simple shore at the "neck" then behaves as any eroding shoreline with all remnants of the former spit form removed. The net effect is to cause the spit to build lakeward farther and farther from shore at its distal end as it builds in a downshore direction. In simplest terms, the spit is rotating on a fulcrum lying somewhere between the distal and proximal ends. Toward the proximal end the spit erodes and toward the distal end it accumulates sediment.

As the shore at the proximal end continues to erode the spit rotates more and more until an increasing length of the spit is presented to the normal direction of highest wave energy. The migration of the fulcrum point toward the distal end causes the spit to ultimately disappear or, when a new attachment is made to the coast, re-establishes the spit and the cycle begins anew.

As sand and gravel sweep the lakeward side of the spit, larger waves cast this sediment many feet above mean water level and smaller waves raise the surface slightly nearer the water's edge. The spit owes its relief above lake level to this phenomena. This sediment can be reworked by wind producing dunes in the backshore.

In the area of Gull Point, dunes first develop on beach berms adjacent to the beach face accumulating as low, barren ridges. As accretion raises the elevation of the dunes above the water level, vegetation begins to occupy these young low ridges and slow the velocity of the wind thus creating a wind shadow. This results in the accumulation of more wind transported sand along the ridge which increases the height, length, and width of the dune. Subsequently denser vegetal growth results in the creation of a still greater wind shadow which, in turn, aids in the progressive growth of the dune. As vegetal and dune growth progress, littoral accretion occurs along the beach face including the development of a new berm and the dune building process is repeated. The ultimate result is a succession of aligned dunes and depressions that show a progressive change in dune size and vegetation. The dunes at Gull Point develop in this manner and are all oriented west-to-east.

1.6.2 Captured Dunes

The ridges that can be seen in the forest from the roadway and hiking trails have exactly the same orientations as the dunes that are developing at the distal end. In fact, the depressions between these forested ridges contain

sand, pebbles and cobbles of the same characteristics as presently observed at the distal end. The assumption that these ridges are ancient dunes that were formed upon the distal end of the spit in the past could be made. These dunes were preserved by the vegetal cover and provide a history of the dynamic change the sandspit experienced through part of its existence. The ancient dunes are called captured dunes.

Since the processes building the spit operate intermittently, successive embankments are added as the spit grows lakeward. These successive embankments may be closely spaced with shallow depressions between. If these depressions are below water level, the embankments may be separated by lagoons. These beach ridges are interesting since they mark the geological growth of the spit. For example, if the ridges are far apart and separated by deep water, the indication is that the spit experienced significant growth at the expense of coastal erosion at and beyond the proximal end.

1.6.3 Shoreline Dynamics

Shoreline stability in any unprotected natural coastal zone is controlled by the supply, transfer, and loss of material (McGill, 1980). Sand accumulation at any point on the shore is equal to the amount of sand in the system minus the amount lost downshore and/or lost offshore. Presque Isle State Park persists because the incoming supply of sand is more or less equal to the amount being lost to other parts of the system.

Rather than being stable for any length of time, the beach is in a process of dynamic equilibrium through time unless the natural processes are thrown out of balance by a drastic change in the amount of beach material, changes in lake level, by storm waves in a 50-100 year event, or various other factors. The supply of sand to the system originates updrift. The sources are streams carrying sediment to the littoral and/or material wasted from the shoreline itself including the sand content of the bluff.

A beach may be temporarily eroded by storm waves and then restored by the milder constructional wave. In addition, the erosion and accretion patterns may occur seasonally. The long-term configuration of the beach is totally dependent on supply. For example, the shore will accrete sand and will prograde when the rate of supply of sand exceeds the rate of loss.

2.0 PROJECT INITIATION

This section deals with the initiative that was undertaken by the Bureau of State Parks to meet with other state and federal agencies to develop a Geographic Information System (GIS) Program for Presque Isle State Park. This initiative required establishing agreements, setting up training, and specifications for hardware and software.

2.1 Geographical Information System

Geographic Information Systems (GIS) are basically a set of computer programs that allow the construction, display, and analysis or maps. They are an advanced mode of computerized mapping. The use of maps and other drawings is a common activity shared by all the functions of the Bureau of State Parks. The use of GIS increases the comprehensiveness and efficiency of map use.

GIS operates first by developing a computerized description of all the information contained on a map or drawing. Each point, line, polygon (area), letter, or number

on a map sheet is translated into a series of code numbers (digits) and entered into the computer. This process is referred to as digitizing.

The digitized media can be traditional maps or drawings, aerial photographs; satellite images, or digital descriptions of phenomena from surveyor's notes to electronic scanners.

GIS main function is the manipulation of the data information in the computer. This is the power of the system. First, a GIS can automatically change scale, combine maps of different scales, add coloration to differentiate features, and add legends and titles to the map without having to redraw or alter photographically the map. This is a major advance in both efficiency and completeness. This frees time for more complex analysis into the problem at hand or for performing other tasks.

GIS allows for new information to be generated from the map base with remarkable savings of time and effort. Calculations of area (acreage of wetlands, open fields), linear distances (miles of fencing, roads, earthworks), slope and aspect, and many other land characteristics can automatically be determined with the GIS.

A major strength of GIS is the ability to combine maps and drawings of different scale and themes to develop maps that did not exist previously. For example, a historic vegetation map and a map of present conditions can be automatically combined to produce a new map highlighting areas of similarity and change. This is an extremely useful tool for cultural and natural resource management purposes.

2.2 Meetings

This project required meetings with Pennsylvania Department of Environmental Resources (PA DER), U.S. Geological Survey, Eastern Mapping Division (USGS EMD), private vendors, and the National Park Service (NPS) to pull the project together.

Initial meetings were held between August, 1992, and March 1993, with PA DER staff from the Bureau of State Parks (BSP), Bureau of Topographic and Geologic Survey (BTGS), Bureau of Information Systems (BIS), and the Comptroller's Office. The purpose of these meetings was to establish purchasing guidelines and to look at time constraints, to insure this system would function with the rest of PA DER computer system programming and responsibality for handling any agreement that may be required. At this time BSP requested BTGS handle agreements with USGS EMD (Exhibit 2-1) since they were handling other joint agreements.

Between January 1993, and March 1994, numerous meetings were held with USGS EMD concerning hardware, software, the requirements of the joint agreement between PA DER and USGS EMD, technical assistance, and what USGS EMD would provide to PA DER in a product form.

During 1993 state park staff met with NPS and New Jersey's GIS staff regarding what they are doing, what works, what doesn't, and available resources. The NPS provided state parks with sample GIS programs being used in northeast United States.

The final set of meetings with Earth Information Services (EIS) was held from June 1994, to the end of October 1994, to assist state parks with finalizing the program. These meetings were held biweekly with Central Office staff and/or Presque Isle State Park staff.

2.3 Agreements

In addition to the Memorandum of Understanding of January 1, 1993, between Division of Coastal Programs, Bureau of Land and Water Conservation and the Bureau of Topographic and Geologic Survey and Bureau of State Parks three other agreements were entered into to complete the project.

On May 3, 1993, Joint Funding Agreement (Exhibit 2-1) TGS 92-6 (594PA01709) was signed between the USGS EMD and PA Bureau of Topographic and Geologic Survey was signed. This agreement provided for technical assistance, in developing GIS program, recommendations for hardware and software components, Digitalortho-quarterquads (DOQQ's), and digital line graphs (DLG's) and digital elevation modules (DEM's) for the Presque Isle State Park pilot GIS project. The products were furnished to the BSP in both digital and hardcopy format. The layers of coverage provided included transportation, boundary, hypsography, and hydrology. Two years (1987 and 1993) of DOQQ's were received in hardcopy and image format. All of this data was used in developing the GIS coverages and will be of assistance in the future.

The only problem BSP had with USGS EMD was their limited experience with Arc Info and unable to work at a small scale.

A second agreement with Planned Dynamics (Exhibit 2-2) for training on using Global Positioning System (GPS) equipment was entered into in July 1994. This equipment was needed to perform additional mapping of features at Presque Isle State Park for when BSP did not have any accurate information on which to create coverages.

The final agreement was with Earth Information Service (Exhibit 2-3) for technical assistance. The contract was used to assist the BSP with finding solutions to problems on creating other coverages and writing application for use by Presque Isle State Park's staff.

2.4 Equipment

This section discusses the hardware and software purchased to develop a functional GIS program.

2.3.1 Hardware

The Presque Isle State Park GIS program was set up to have a 486 DX2/66TE Personal Computer and eight pen plotter at Presque Isle State Park. This equipment would be supported by a workstation digitizing tablet, and 486 DX2/66TE personal computer in BSP Central Office, Harrisburg. See Exhibit 2-4 for a complete listing of hardware.

2.3.2 Software

A combination of software will be used to support the BSP GIS program. Arc Info will be the primary analytic software used for performing major application. The Central Office staff will be responsible for developing the various coverage and applications. Presque Isle State Park will use ArcView 2, a product of Arc Info, for the mapping and applications at the state park. Arcview is a more user friendly software package that requires very little training especially compared to Arc Info itself.

EXHIBIT 2-1
LETTER TO BTGS

Commonwealth of Pennsylvania
Environmental Resources
August 27, 1992

In reply refer to
PF-P-O

Subject: Presque Isle GIS Pilot Project
Presque Isle State Park

To: Donald M. Hoskins, Director
Bureau of Topographic and Geologic Survey

From: Roger Fickes, Director
Bureau of State Parks

This in reference to the meeting on August 18, 1992, on the pilot GIS project at Presque Isle State Park.

The Bureau of State Parks would appreciate the Bureau of Topographic and Geologic Survey handle the cooperative agreement between the United States Geological Survey and Department of Environmental Resources.

In regards to the 1:12,000 scale used by the USGS National Mapping Division, this scale will be acceptable to the Bureau of State Parks.

cc: Presque Isle State Park
Park Region 2
Tom Baldwin
George Burns
Frank Haas
File - PF-P-O
Daily

RF:KAT:lsk

EXHIBIT 2-2
USGS AGREEMENT 594 PA 01709

TGS-92-6

Form 9-1366
(REV. 6/86)

Enclosure 1

GEOLOGICAL SURVEY
JOINT FUNDING AGREEMENT
FOR

THIS AGREEMENT is entered into as of the 22nd day of March 1992 by the GEOLOGICAL SURVEY, UNITED STATES DEPARTMENT OF THE INTERIOR, party of the first part, and the Pennsylvania Department of Environmental Resources, Bureau of Topographic and Geologic Survey party of the second part.

The parties hereto agree that subject to the availability of appropriations and in accordance with their respective authorities there shall be maintained in cooperation a project to collect 1:100,000-scale digital data over the State of Pennsylvania herein called the program.

The following amounts shall be contributed to cover all of the cost of the necessary field and office work directly related to this program, but excluding any bureau level general administrative or accounting work in the office of either party.

(a) $ 94,370 by the party of the first part during the period beginning on the date of this agreement to March 31, 1994.

(b) $133,845 by the party of the second part during the period beginning on the date of this agreement to March 31, 1994.

(c) Additional amounts by each party during the above period or succeeding periods as may be determined by mutual agreement and set forth in an exchange of letters between the parties.

Expenses incurred in the performance of this program may be paid by either party in conformity with the laws and regulations respectively governing each party, provided that so far as may be mutually agreeable all expenses shall be paid in the first instance by the party of the first part with appropriate reimbursement thereafter by the party of the second part. Each party shall furnish to the other party such statements or reports of expenditures as may be needed to satisfy fiscal requirements.

4. The field and office work pertaining to this program shall be under the direction of or subject to periodic review by an authorized representative of the party of the first part.

5. The areas to be included in the program shall be determined by mutual agreement between the parties hereto or their authorized representatives. The methods employed in the field and office shall be those adopted by the party of the first part to insure the required standards of accuracy subject to modification by mutual agreement.

6. During the progress of the work all operations of either party pertaining to this program shall be open to the inspection of the other party, and if the work is not being carried on in a mutually satisfactory manner, either party, may terminate this agreement upon 60 days written notice to the other party.

7. The original records resulting from this program will be deposited in the office of origin of those records. Upon request, copies of the original records will be provided to the office of the other party.

8. The maps, records or reports resulting from this program shall be made available to the public as promptly as possible. The maps, records or reports normally will be published by the party of the first part. However, the party of the second part reserves the right to publish the results of this program and, if already published by the party of the first part shall, upon request, be furnished by the party of the first part, at cost, impressions suitable for purposes of reproduction similar to that for which the original copy was prepared. The maps, records or reports published by either party shall contain a statement of the cooperative relations between the parties.

9. Billing for this agreement will be rendered quarterly on actual expenses. Payments of bills are due within 60 days after the billing date. If not paid by the due date, interest will be charged at the current Treasury rate for each 30-day period, or portion thereof, that the payment is delayed beyond the due date (31 USC 3717; Comptroller General File B-212222, August 23, 1983).

GEOLOGICAL SURVEY
UNITED STATES
DEPARTMENT OF THE INTERIOR

By _____
(SIGNATURE AND TITLE)
K. Eric Anderson, Chief, Eastern Mapping Center

PENNSYLVANIA DEPT OF ENVIRONMENTAL RESOURCES
BUREAU OF TOPOGRAPHIC & GEOLOGIC SURVEY

By _____ Date _____

By _____ Date 5/3/93
Arthur A. Davis, Secretary

By _____ Date _____

(USE REVERSE SIDE IF ADDITIONAL SIGNATURES ARE REQUIRED)

APPROVED AS TO LEGALITY AND FORM

Office of Attorney General

Chief Counsel
Department of Environmental Resources

Fed. ID #53-0196958

I hereby certify that funds in the amount of $133,845 are available under appropriation symbol 001-035-501-~~X~~-5-0100-00022-310 (ME 91498) 01G

ME 92610

Comptroller

APPROVED:

Secretary, Office of the Budget

Date_____

EXHIBIT 2-3
PLANNED DYNAMICS
SHOW THIS NUMBER ON INVOICE

[redacted] OF PENNSYLVANIA
REV. 4-93
7-13-89

SERVICE PURCHASE CONTRACT

ICS 310 ☐ 320 ☐

SP 249388

SERVICE TO (AGENCY)
[redacted]ent of Environmental Resources
[redacted] Forestry Administration
Fl., Market Street State Office Building
&[redacted]arket Streets
i[redacted]urg, PA 17101-2301

BILL TO (PROVIDE ORIGINAL AND TWO COPIES OF INVOICE)
Dept. of Environmental Resources
Parks & Forestry Administration
P.O. Box 8551
Harrisburg, PA 17105-8551

PAN NO

DATE PREPARED
7 / 5 / 94

EFFECTIVE DATE
7 / 21 / 94

TERMINATION DATE
7 / 22 / 94

ANTICIPATED DELIVERY DATE
/ /

CONTRACT NOT TO EXCEED
$ 1,400.00

CONTRACTOR'S NAME AND ADDRESS
[redacted]
Planned Dynamics, Inc.
684 E. Main Street
Middletown, NY 10940

CONTRACTOR'S FEDERAL ID NO.-SOC SEC NO
X 22-2781987

CONTRACTOR'S LICENSE OR REGISTRATION NO

CONTRACTOR'S TELEPHONE NO
X 914-341-0707

SERVICES REQUESTED	QUANTITY	UNIT PRICE	TOTAL PRICE
[redacted]e training on Geographic Positioning System [redacted]er the attached GPS Training Agenda and letter d May 27, 1994.			
[redacted]		TOTAL	1,400 00

[redacted]TRACTOR AGREES TO THE TERMS AND CONDITIONS ON THE REVERSE SIDE AND ATTACHMENTS, IF [redacted], WHICH ARE PART OF THIS CONTRACT. THIS CONTRACT IS NOT VALID OR ENFORCEABLE UNTIL FULLY [redacted]CUTED, APPROVED AND DELIVERED TO THE CONTRACTOR.

[redacted]S OR AGREEMENTS
[redacted]ctor agrees to comply with Attachment A, Provisions for Commonwealth Contracts, as [redacted]ched.

[redacted]STIFICATION FOR ABOVE
Service is needed to provide adequate skills in using Geographic Positioning System units collecting data in real world coordinates. This information is to be downloaded into DER u[redacted]ers to create various resources management maps and databases.

[redacted]
ie Lincoln 717-783-3309
[redacted] Morrow 717-772-1216

INITIATING AGENCY'S SIGNATURE — DATE — CONTRACTOR'S TITLE
X [signature] X 7/12/94 X MKTG. MANAGER

[redacted]PT	APP	YR	LDG	ORG	COST FU[redacted]	[redacted]ION	OBJ	AMOUNT OF ENCUMBRANCE	PRE-ENCUMBRANCE NUMBER	AMT. OF PRE-ENC. LIQUIDATED	CODED
035	134	94	1	6600	66000		152	1,400 00			THE-AUDIT
											POSTED

[redacted]ED AGENCY ATTORNEY — DATE — COMPTROLLER (OR DESIGNEE) — DATE

[redacted]NERAL COUNSEL (IF REQUIRED) — DATE — AGENCY HEAD (OR DESIGNEE) — DATE
[signature] 7/21/94

[redacted] ATTORNEY GENERAL (IF REQUIRED) — DATE — SECRETARY OF THE BUDGET (OR DESIGNEE) — DATE

EXHIBIT 2-4
EARTH INFORMATION SERVICES

[redacted] OF PENNSYLVANIA
REV. 4-93
[redacted]-200
[redacted] 7-15-89

SHOW THIS NUMBER ON INVOICE

SERVICE PURCHASE CONTRACT

ICS ☐ 310 ☐ 320

SP 239162

SERVICE TO (AGENCY)	BILL TO (PROVIDE ORIGINAL AND TWO COPIES OF INVOICE)	PAN NO.
[redacted]f Environmental Resources [redacted] of State Parks 1., Market St. State Office Bldg. [redacted]arket St. [redacted]urg, PA 17101-2301	Dept. of Environmental Resources Bureau of State Parks P O Box 8551 Harrisburg, PA 17105-8551	DATE PREPARED 4 / 19 / 94 EFFECTIVE DATE 6 / 1 / 94
CONTRACTOR'S NAME AND ADDRESS	CONTRACTOR'S FEDERAL ID NO./SOC. SEC. NO.	TERMINATION DATE
[redacted] Commonwealth Engineering & Technology, Inc. T/A Earth Information Services 1240 N. Mountain Road Harrisburg, PA 17112	23-2092961	12 / 31 / 94
	CONTRACTOR'S LICENSE OR REGISTRATION NO.	ANTICIPATED DELIVERY DATE / /
	CONTRACTOR'S TELEPHONE NO. 717-541-0644	CONTRACT NOT TO EXCEED $ 10,125.00

SERVICES REQUESTED	QUANTITY	UNIT PRICE	TOTAL PRICE
[redacted]le Geographic Information System (GIS) coverages [redacted]dance with the attached Invitation - Bid [redacted] and Specifications. [redacted] Hour: $45.00			
		TOTAL	10,125.00

[redacted]TRACTOR AGREES TO THE TERMS AND CONDITIONS ON THE REVERSE SIDE AND ATTACHMENTS, IF [redacted] WHICH ARE PART OF THIS CONTRACT. THIS CONTRACT IS NOT VALID OR ENFORCEABLE UNTIL FULLY [redacted]UTED, APPROVED AND DELIVERED TO THE CONTRACTOR.

[redacted]DITIONS OR AGREEMENTS

[redacted]tor agrees to comply with Attachment A, Provisions for Commonwealth Contracts, and [redacted]ment B, Federal Requirements, as attached.

[redacted]D JUSTIFICATION FOR ABOVE

[redacted] expertise necessary to complete preparation of GIS in the development of resource [redacted]t GIS's for the entire park system.

[redacted] TELEPHONE NO. | CONTRACTOR'S SIGNATURE | DATE | CONTRACTOR'S TITLE

[redacted]e Lincoln 717-783-3309 | Jeffrey D. Wells | 5/5/94 | President

DEPT	APP	YR	LDG	ORG	COST FUNCTION		OBJ	AMOUNT OF ENCUMBRANCE	PRE-ENCUMBRANCE NUMBER	AMT. OF PRE-ENC. LIQUIDATED	CODED
[redacted]5	701	93	7	3940	00113		310	1000.00			PRE-AUDIT
[redacted]35	501		5	0100	00022		310	5062.50			
[redacted]35	701	94	7	3940	00113		310	4062.50			POSTED

[redacted]GENCY ATTORNEY — DATE WOC 5/9/94

COMPTROLLER (OR DESIGNEE) — DATE 5/24/94

[redacted]ENERAL COUNSEL (IF REQUIRED) (Not Required) — DATE

AGENCY HEAD (OR DESIGNEE) Delia M. Cupassa — DATE 5-25-94

ATTORNEY GENERAL (IF REQUIRED) — DATE

SECRETARY OF THE BUDGET (OR DESIGNEE) — DATE 5/27/94

EXHIBIT 2-5

HARDWARE

Central Office

CADD Station

Sun Space Station 1PX, MODE/ 4/50GX-16-P43
19" Color Monitor
16 MB RAM with 16MB Memory Expansion
1.5 GB SCSI Disk Drive
Digitizer, Calcomp 95360, 24" x 36"
Raster Flex 24 Bit Graphics Card
Sun 2.1 GB Ext Fast SCS12

Resources Management Section

486 Freedom Microprocessor DX2/66MHZ
16 MB of RAM
300 MB Hard Drive
2 MB Video RAM
17" SVGA Color Monitor
CD-ROM Reader

Presque Isle State Park

NEC PM DX2/GGTE 8 MB RAM, 535 MB
Multisync 5FG Monitor
4 MB Simm Upgrade Kit
Hewlett Packard Plotter, Draft Pro DXL, Size A-D
Calcomp Digitizer, Drawing Board, 16 Button

Support software to be used by BSP staff includes AutoCadd, Cad Overly, and Soft Desk Civil Survey package. The primary function of the two Cadd packages is to do mapping. The Soft Desk Civil software will be used to create the official boundary map. All of this information will then be exported into Arc Info for use by the state park. This software is not available for use by the park staff.

2.5 Training

Training was provided to BSP staff by the USGS EMD, Environmental Scientific Research Institute (ESRI), Planned Dynamics, and Earth Information Services. All training was geared towards the use of various software and how to apply them in creating coverage.

Training performed by the various agencies is listed below:

- 120 hours of Introduction to Arc Info for three people
- 80 hours of Durance Arc Info for three people
- 24 hours of UNIX Operating System for three people
- 144 hours of GIS Training from USGS EMD for six people
- 24 hours of Digitizing Training for four people
- 75 hours of GPS Training for five people

3.0 DATA COLLECTION

3.1 U.S. Geological Survey

The USGS provided data on a 1-24,000 scale for transportation (roads, pipelines, railroads, utilities, bridges, parking lots, and trails), boundary lines (state, county, municipality, and government agency boundaries), hypsography (contours), hydrography (lakes, ponds, streams, and wells), man-made structures (buildings thatcan be seen from the air), vegetative (forested areas), and non-vegetative (non-forested areas). Of these layers the only ones that could be used for Presque Isle State Parks project where the boundary, transportation, and hydrography coverage. All the other covers were not detailed enough to use at a 1-4,800 scale. Plus there were other sources available to get more detailed information.

The DOQQs that were obtained from USGS EMD proved to be of great help for verification of items when a discrepancy or question arose. These photos allowed staff the possibility of seeing the area in question and if need be redigitizing it from the images.

3.2 RBA Study

The RBA Group was contracted in 1989 to prepare an Environmentally Sensitive Area Study to identify the most Environmentally Sensitive Areas (ESA) within the state park requiring special management consideration. The project approach employed for this study recognized a need to manipulate a large array of existing data at various scales and detail in order to identify the most significant and sensitive natural sites within the state park. The methodology focused on an explicit and replicable process for this identification. A GIS provided the means and flexibility to manipulate the data in a manner which, if done in a traditional hand overly method, would have been overly cumbersome and limited.

The methodology for the ESA study was effected in four steps: data collection, data analysis, analysis modeling, and data synthesis. The data collection effort first classified the data gathered using a standard nomenclature. Data useful for

modeling purposes was then encoded into a uniform grid cell data base addressable by the GIS command language. Data analysis, Step 2, was conducted concurrent with the data collection effort and provided the data sift. Existing available information regarding the state park's resources was obtained the state park's archives and workshops held with state park researchers and staff. Step 3 involved the creation of analysis models using the GIS command language. Individual models were developed for each predefined ESA criteria. A composite model identified the most significant areas within the state park or the ESA "hot spots." Step 4 transferred locations highlighted by the composite model to the topographic base map of the state park by correlating the ESA "hot spots" to identifiable ground features, natural community boundaries, and cultural or biological edges. Nineteen discrete ESAs were delineated.

An ESA is defined as: *An area which contains an ecosystem whose biological and physical integrity, as well as its ecological processes, should be maintained and protected.* Within a state park, they are the most significant and sensitive natural sites. They require special consideration in the determination of management actions because of the sensitive features that they contain.

All of this data was collected at a 1-9,600 scale in a grid format.

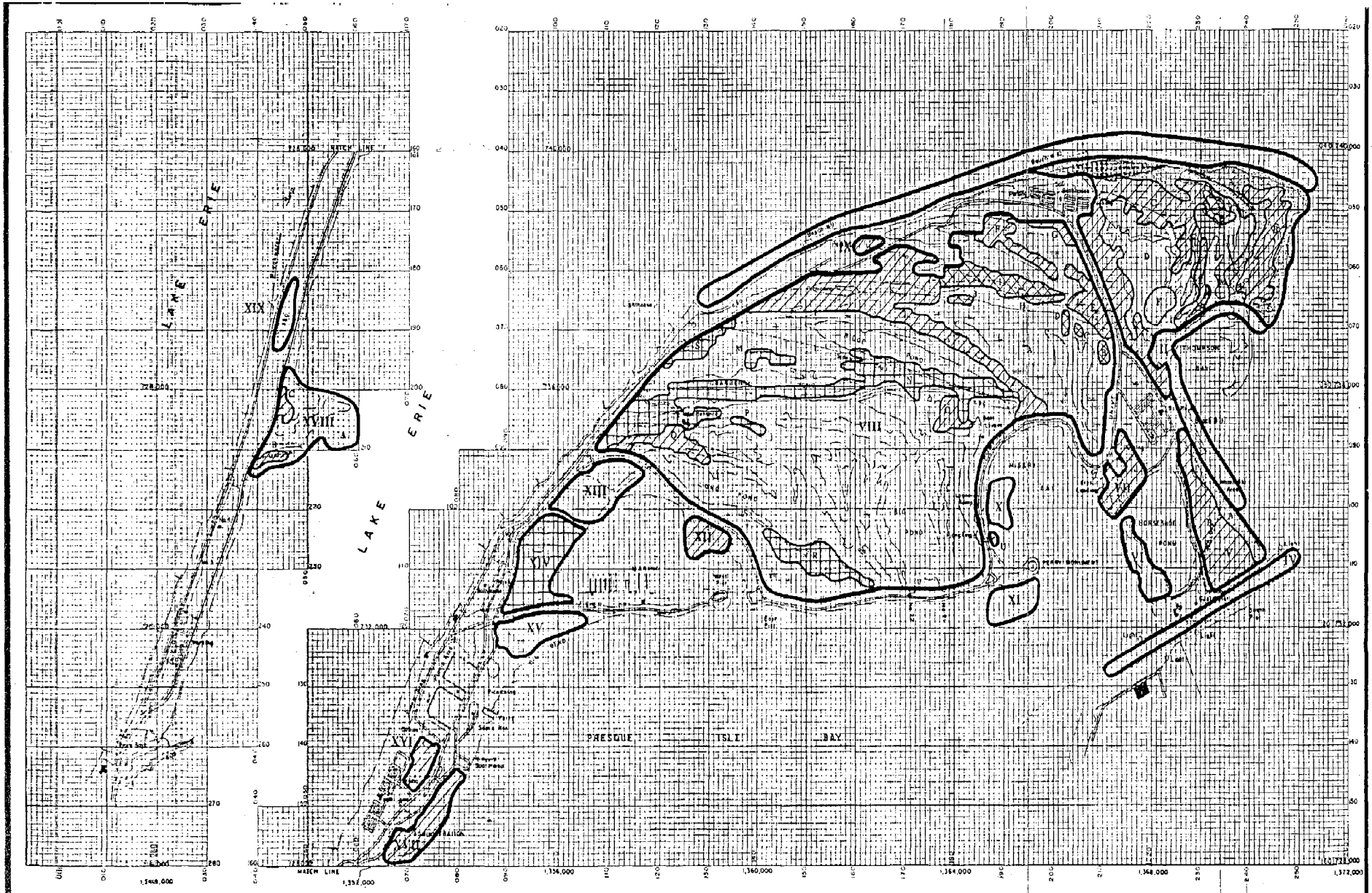
For use at Presque Isle State Park this information was taken from a raster format into a vector format for smoother lines and continuity with the GIS program. Exhibit 3-1 shows the numerous critical areas that must be considered when managing Presque Isle State Park.

3.3 Global Positioning System (GPS)

A method that was tried as part of this project was creating coverage using GPS equipment. The level of accuracy that the hand held GPS units provided the BSP was one of one to two meter accuracy. It has been determined that for most of state park mapping this level of accuracy will be sufficient.

A team of four scientific, engineering, and technical interns from the Bureau of State Parks carried out a pilot GPS exercise at Presque Isle State Park. The crew chief used Trimble software to build a data dictionary which outlined the features and attributes that were to be collection. The crew collected data for various features such as: trails, water utilities, PNDI, control points, shorelines, and signs.

The trails required the use of an all terrain vehicle (ATV) to GPS their locations. An intern from the state park assisted with finding the trails and driving the ATV. The ATV was also used to complete the shoreline. A state park maintenance person helped one of the interns locate all of the water utilities such as shutoffs, fountains, etc. A team from the Cleveland Museum of Natural History located plants of special concern for the interns to collect data from. The signs were started on our first day at the state park but we soon realized that it would take over a week to get locations for every sign with both professional pathfinders being utilitized. The interns started at 7:30 a.m. and were collecting data within 30 to 40 minutes. The data was down loaded into a PC at lunchtime and at the end of the day. Each evening the batteries were recharged and summaries were computed that outlined any problems or suggestions concerning that days work. The training that we received from Planned Dynamics proved to be satisfactory. The interns were able to solve any problem that arose throughout the week without any outside help. The project was a learning experience and a definite success. The maps that are being compiled from the data will have an accuracy within 1-2 meters of the features that were collected.



Environmentally Sensitive Areas

ESA I	Transport Zone Darter	ESA VI	Horseshoe Pond Peninsula	ESA XI	Crystal Point Mollusk Bed	ESA XVI	Cabin Woods
ESA II	Bay Darter	ESA VII	Fry's Landing	ESA XII	Marina Drive Promontory	ESA XVII	Administration Backyard
ESA III	Gull Point Sanctuary	ESA VIII	Ecological Reserve	ESA XIII	Duck Pond	ESA XVIII	Old West Boat Livery
ESA IV	Lake Sturgeon Channel	ESA IX	Beach #9 Sandplain	ESA XIV	Red Maple Swamp	ESA XIX	Old Dune
ESA V	Coast Guard Flats	ESA X	Misery Bay Mollusk Bed	ESA XV	Big Bend		

Presque Isle State Park

Environmentally Sensitive Area Study

Prepared for the Commonwealth of Pennsylvania Department of Environmental Resources Bureau of State Parks

Date: June, 1989

Prepared by RBA

Coastal Zone

This project was financed through a Federal Coastal Zone Management Grant from the Pennsylvania Department of Environmental Resources with funds provided by the National Oceanic and Atmospheric Administration.

SCALE IN FEET

The data points were transformed from a PC to a workstation running Arc Info. This process was difficult but staff was able to create coverages with attributes and plot accurate maps. Staff had the option of tracking the data into AutoCad. This process may be more simple than using Arc. This is one avenue that will be explored with future projects.

3.4 Hardcopy Maps

This section identifies ways that information is put into the system using existing maps and photographs from any source such as BTGS, Bureau of Facility Design and Construction (BFDC), BSP, and U.S. Army Corps of Engineers.

3.4.1 Raster Images

This method involves scanning a map, item, design, or photograph into the computer system so it shows up on the monitor. Once you have image staff can use a tracer command to follow specific lines or else the operation can use the cursor to digitize over the elements that are to be captured in the particular coverage.

A raster image is made up of a group of cells that represent a point, line, or area as a matrix of values. This term comes directly from digital display which is an area which can individually illuminated from scanning a line. The size of cell dictates the level of resolution. A large cell provides a lower level of resolution. This resolution is reflected in the display. The display will be displayed in straight lines.

3.4.2 Vector Image

Vector is the other form of image on electronic mapping. Instead of using a cell as done in raster images vector uses a set of Cartesion (X,Y) coordinate to create the pricture. Lines are created by stringing a set of these coordinate from one point to another, a polygon is created by a string or coorinates having a common start and end points while a point is just X,Y location.

This form of image creates a much smoother and accurate picture compared to a raster image. In the past the slowness of creating this image was a disadvantage but advances in technology have pretty much elimated the slowness.

3.4.3 Digitizing

Reality is best represented by visual images such as maps. Digitizing is the conversion hardcopy maps to electronic digital form. Digitizing assigns electronic codes such that contour lines of maps, for example, are represented by digits which are the language of computers. The most common form of digitizing is the manual tracing with a cursor of a map that has been mounted and registered on a digitizing table. The term is also used to describe the conversion of maps to digital form through scanning or other techniques.

This form of data collection uses a digitizing tablet and cursor to enter in points, arcs, or polygons. This information can be in forms such as a map, photograph, or a design.

3.4.4 Scanning

Graphic elements can also be created by scanning. By measuring the value of light, color, or shading of maps, photographis, drawings, or flat objects a unique machine called a scanner is used to create a raster duplicate.

Each cell in the scanned raster image is called a pixel. The density of pixels per inch that the scanner can measure establishes the resolution. PA DER is scanning images at 800 pixels per inch which is good resolution.

3.5 Remote Sensing

When you combine aerial photography and satellite imaging to create with a digital raster image or vector image this is called remote sensing. These images are used to assist in correctly registering other spatial data to real earth coordinates or to produce land use or other theme maps classified to a particular use.

When aerial photography is gathered work must be done in the photo to correct for camera angle and terrian changes. This corrected photograph is then called an orthophotograph.

3.6 Administrative Records

Not all the information for producing coverages is in map form but may be in databases located in park office files. This information for Presque Isle State Park included ground monitoring well location, incident reports, and lifeguard reports. This data can be read by Arc Info to create spatial maps on where the walls are and locations of a high number of incidents. There must be a common link between the database and real world coordinates.

The automation of non-graphic data is just as important to a GIS as the graphic data. This is done using standard data processing methods of entry at a terminal, PC, or workstation.

3.7 Coordinate Geometry

The final way information was inputted into Presque Isle State Park GIS program was through actual entering of coordinate information. This method was used primarily for entering boundary data for centimeter accuracy. The Arc Info software computes the coordinate values for the geometric description by using a program called COGO. Another software package that computes coordinate values is Soft Desk Civil Survey software.

This program requires a defined beginning point which continuing bearings and distances. All of this data is provided to the BSP through surveys completed by BFDC or from deed when the land was acquired.

3.8 Other Sources of Data

In addition to collecting/gathering information from the USGS EMP the BSP used other sources. Maps from commercial vendors were used for comparison and template, breakwater, baseline, and raster imaging was obtained from Army Corps of Engineers, utility data was obtained from General Telephone Comapny and Penelec (this information has not been converted into spatial data for the 92 CZM project but will be done for 93 CZM project), information from Mill Creek Township and City of Erie regarding the water lines in Presque Isle State Park, information

from other Bureaus in PA DER, Soil Conservation SErvice, and National Oceanic and Atmospheric Administration (NOAA).

4.0 Bureau of State Park Map Standards

This section contains the standards for producing maps, naming maps, and metadata for Presque Isle State Park as well as the other 113 state parks.

4.1 Naming Convention

The filename will consist of three letter indentification code for each park it is dealing with (Exhibit 4-1). For example, Presque Isle State Park = PRE. The next three to five letters dictate the type of data or map theme (Exhibit 4-2). This list is not exhaustive. When additional themes are required the name will be approved by BSP GSI coordinator. If a file deals with changing data, eg. moving requires or boundary changes include the month and year (MMYY) in the filename for the time period the file addresses. An example for Presque Isle State Park boundary map PREBY794.

For all maps created, the .gra extension must be applied. The BSP standard projection is State Plane, NAD 83 for all final coverages.

Once the project, like Presque Isle State Park, is completed the coverages will be moved to a CD ROM for the individual park and copies to the park. In this case Presque Isle State Park will have a CD in Central Office and a copy of each coverage will be sent to the park. Information will be stored on a CD because BSP does not have a storage capability on a hard drive for 114 parks.

4.2 Metadata

Each coverage will have a metadata form (Exhibit 4-3) completed for the coverage as shown in Exhibit 4-4. For Presque Isle State Park a copy of the metadata will be provided to Mike Gagnon, PA DER GIS Coordinator, BIS; Coastal Zone Management; and Presque Isle State Park. This information will be supplied at the conclusion of Phase II of this project in 1995.

The Resources Management Section maintains a log file (Exhibit 4-5) and GIS MAP File (Exhibit 4-7) for each coverage created at Presque Isle State Park as well as the other parks. A sample of a log sheet (Exhibit 4-6) and GIS MAP File (Exhibit 4-8) for Presque Isle is provided in this report.

4.3 Display and Output

The biggest advantage of GIS is one's ability to display information in a graphic and tabular form after doing some type of query on the information.

Products from a GIS include textual or tabular, maps, and charts and business graphs. When you combine a visual product with the actual data it is the best understood by the user.

It is important that the visual maps produced for Presque Isle State Park as well as other parks are always outputted in a standard line coding. Therefore, a standard line type, color and size (Exhibit 4-9) has been established for BSP during the Presque Isle State Park Pilot GIS Project.

EXHIBIT 4-1

STATE PARK CODING FOR NAME

Code	State Park Name
ARC	Archbald Pothole
BAL	Bald Eagle
BEL	Beltzville
BEN	Bendigo
BER	Benjamin Rush
BIS	Big Spring
BLA	Black Moshannon
BLU	Blue Knob
BUB	Buchanan's Birthplace
BUC	Bucktail
CAL	Caledonia
CAN	Canoe Creek
CHA	Chapman
CHE	Cherry Springs
CLE	Clear Creek
COD	Codorus
COL	Colonel Denning
COP	Colton Point
COO	Cook Forest
COW	Cowan's Gap
DEL	Delaware Canal
DEN	Denton Hill
ELK	Elk
EVA	Evansburg
FOR	Fort Washington
FOW	Fowler's Hollow
FRA	Frances Slocum
FRE	French Creek
GIF	Gifford Pinchot

Code	State Park Name
GOU	Gouldsboro
GRE	Greenwood Furnace
HIR	Hickory Run
HIL	Hillman
HIC	Hills Creek
HYR	Hyner Run
HYV	Hyner View
JAC	Jacobsburg Env. Ed.
JEN	Jennings Env. Ed.
KET	Kettle Creek
KEY	Keystone
KIN	Kings Gap Env. Ed.
KIB	Kinzua Bridge
KOO	Kooser
LAC	Lackawanna
LAH	Laurel Hill
LAM	Laurel Mt.
LAR	Laurel Ridge
LAS	Laurel Summit
LEH	Lehigh Gorge
LEO	Leonard Harrison
LIN	Linn Run
LIB	Little Buffalo
LIP	Little Pine
LOC	Locust Lake
LYM	Lyman Run
MAU	M. K. Goddard
MAR	Marsh Creek
MCD	McCalls Dam

EXHIBIT 4-1

(Continued)

Code	State Park Name
MCM	McConnells Mill
MEM	Memorial Lake
MIL	Milton
MOR	Moraine
MON	Mont. Alto
MTP	Mt. Pisgah
NES	Neshaminy
NOC	Nockamixon
NOL	Nolde Forest Env. Ed.
NOR	Norristown Farm Park
OHI	Ohiopyle
OIL	Oil Creek
OLE	Ole Bull
PAR	Parker Dam
PIN	Pine Grove Furnace
POP	Poe Paddy
POV	Poe Valley
POI	Point
PRE	Presque Isle
PRI	Prince Gallitzin
PRL	Promised Land
PRP	Prouty Place
PYM	Pymatuning
RBW	R. B. Winter
RAC	Raccoon Creek
RAL	Ralph Stover
RAV	Ravensburg
REE	Reeds Gap
RIC	Ricketts Glen

Code	State Park Name
RID	Ridley Creek
RYE	Ryerson Station
SBE	S. B. Elliott
SAL	Salt Springs
SAM	Samuel S. Lewis
SHA	Shawnee
SHI	Shikellamy
SIN	Sinnemahoning
SIZ	Sizerville
SUS	Susquehannock
SWA	Swatara
TOB	Tobyhanna
TRO	Trough Creek
TUS	Tuscarora
TYL	Tyler
UPP	Upper Pine Bottom
WAR	Warriors Path
WHI	Whipple Dam
WHC	White Clay Creek
WOR	Worlds End
YEL	Yellow

EXHIBIT 4-2

BUREAU OF STATE PARK

MAP THEME NAMES

Cover Name	Coverage Description	Cover Type
act	Activity Areas	annotation
arch	Archeological Area	poly
archp	Archeological Points	point
bdmmyr	Presque Isle Shoreline	line
bdycor	Park Corners	point
bldg	Buildings	poly
bndy	Park Boundary	poly
cntrl	Survey Control Points	point
elec	Electric	point
eros	Erosion Control/Breakwaters	poly
esa	Environmental Sensitive	poly
hist	Historical Sites	point
hunt	Hunting Areas	poly
lots	Parking Lots	poly
manhol	Sanitary Sewer Manholes	point
mgt	Management Units	poly
olds	On-lot Disposal Systems	point
PNDI	Pennsylvania Natural Diversity Inventory	poly
poles	Telephone/Electric Poles	point
pond	Lagoons/Ponds	poly
rail	Railroads	line
road	Roads	line
row	Gas and Oil Lines	line
sewl	Sanitary Sewer Lines	line
sign	Signs	point
soil	Soils	poly
stmsew	Stormwater Collection System	line
stru	Structures - Polygons	poly
strup	Structures - Points	point
tank	Tanks (Underground Storage)	point
tele	Telephone Lines	line
topo	Topography/Contour	line
trail	Trails	line
valve	Water Fire, Hydrants, Shutoffs	point
vege	Vegetation	poly
water	Water Distributions Lines	line
well	Monitor Wells	points
wet	Wetlands	poly

EXHIBIT 4-3
PREGIS - 1 (9/94)
METADATA FOR GIS COVERAGES
(This Information is Entered into PRESGIS.DBF)

Filename (Data Set)	
PRESQUE ISLE STATE PARK	**IDENTIFICATION**
Theme Keyword	
Representation Model:	
Transfer Format:	
Data Set Extent:	
Intended Scale of Use:	
Data Set Description:	
	ACCESS
Transfer Mode	
Transfer Instructions	
	PROJECTION
Projection Name	
Noricontrol Datum	
Projection Units	
Projection	

EXHIBIT 4-3
PREGIS - 1 (9/94)
METADATA FOR GIS COVERAGES
(This Information is Entered into PRESGIS.DBF)

Filename (Data Set)	
PRESQUE ISLE STATE PARK	**STATUS**
Degree of Completion:	
Completion Status and Data:	
Percentage Complete:	
Degree of Availability:	
Custodial Policy Status:	
Copyright Status:	
Custodial Liability:	
	REFERENCE SECTION
Revision Dates:	
Review Dates:	
Mandata Contact:	
	SOURCE INFORMATION
Data Set Name:	
Name of Source:	
Scale and Medium:	
Creator:	
Data of Source Material:	
Source Projection Information:	
	DATA CUSTODIAN
Contact Type:	
Contact Person/Title:	
Organization:	
Contact Instructions:	

EXHIBIT 4-3
PREGIS - 1 (9/94)
METADATA FOR GIS COVERAGES
(This Information is Entered into PRESGIS.DBF)

Filename (Data Set)		
Presque Isle State Park	Associated Attribute Tables	
Table Name	**Table Description**	**Intended Use**
1.		
2.		
3.		
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21.		

EXHIBIT 4-3
PREGIS - 1 (9/94)
METADATA FOR GIS COVERAGES
(This Information is Entered into PRESGIS.DBF)

Filename (Data Set)	
Presque Isle State Park	Associated Attribute Tables

Table Name	Attribute Name	Begin-ing Col-umn	Field Name	Alternate Field Name	Input Width	Out-put Width	Field Type	Field Decimals	Relation Info.	Descrip.

EXHIBIT 4-4
PREGIS - 1 (9/94)
METADATA FOR GIS COVERAGES
(This Information is Entered into PRESGIS.DBF)

Filename (Data Set)	SOILS
PRESQUE ISLE STATE PARK	**IDENTIFICATION**
Theme Keyword	Soil
Representation Model:	
Transfer Format:	DXF, EOO
Data Set Extent:	131, 5400, 718000 1340500, 740000
Intended Scale of Use:	1" - 20,000"
Data Set Description:	This set includes the four soil types that are present on Presque Isle State Park.
	ACCESS
Transfer Mode	Internet, 8mm tape, 3 1/2 diskette
Transfer Instructions	Contact Resources Management Section 717-787-6674 or Internet Tecumseh, PA DER.GOV.
	PROJECTION
Projection Name	Soils. Prj
Noricontrol Datum	NAD 83
Projection Units	Feet
Projection	State Plane

EXHIBIT 4-4
PREGIS - 1 (9/94)
METADATA FOR GIS COVERAGES
(This Information is Entered into PRESGIS.DBF)

Filename (Data Set)	SOILS
PRESQUE ISLE STATE PARK	**STATUS**
Degree of Completion:	100%
Completion Status and Data:	Final, Final
Percentage Complete:	100%
Degree of Availability:	100%
Custodial Policy Status:	
Copyright Status:	
Custodial Liability:	
	REFERENCE SECTION
Revision Dates:	None
Review Dates:	10-25-94
Mandata Contact:	Keith Taylor
	SOURCE INFORMATION
Data Set Name:	Soils
Name of Source:	Soil Survey of Erie County, Pennsylvania
Scale and Medium:	1" - 20,000"
Creator:	Jennifer Graves
Data of Source Material:	December 1960, 1950 Aerial Pnotuordeny
Source Projection Information:	State Plane, West Zone, Trasverse Mercayor, NAD 27
	DATA CUSTODIAN
Contact Type:	
Contact Person/Title:	Keith Taylor
Organization:	PA Bureau of State Parks, P.O. Box 8551, Harrisburg, PA 17105
Contact Instructions:	Phone 717-787-6674, Internet Keith, Telumsth, PA DER, GOV

EXHIBIT 4-4
PREGIS - 1 (9/94)
METADATA FOR GIS COVERAGES
(This Information is Entered into PRESGIS.DBF)

Filename (Data Set)	SOILS	
Presque Isle State Park	Associated Attribute Tables	
Table Name	**Table Description**	**Intended Use**
1. Slope	Slope Degrees	
2. Capability	Needs and Limitation of the Soils	If Suitable for Recreation
3.		
4.		
5.		
6.		
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EXHIBIT 4-4
PREGIS - 1 (9/94)
METADATA FOR GIS COVERAGES
(This Information is Entered into PRESGIS.DBF)

Filename (Data Set)	SOILS
Presque Isle State Park	Associated Attribute Tables

Table Name	Attribute Name	Begin-ing Col-umn	Field Name	Alternate Field Name	Input Width	Out-put Width	Field Type	Field Decimals	Relation Info.	Descrip.
Slope	Slope				5	5	C	0		Range
Capability	Capability						C	0		Rating

EXHIBIT 4-5
PREGIS - 2 (9/94)
GIS COVERAGE LOG BOOK

Project Name:	File Description:

Date	Name	Coverage	Changes, Corrections, Elections, Additions Include Geographic Changes

EXHIBIT 4-6
PREGIS - 2 (9/94)
GIS COVERAGE LOG BOOK

Project Name: PIGIS	File Description: Presque Isle State Park Coverage

Date	Name	Coverage	Changes, Corrections, Elections, Additions Include Geographic Changes
9-30-94	Jennifer Graves	Soils	NAD 27 to NAD 83 and Attributed
10-12-94	Gerry Johnston	Buildings	Cleaned and Surveyed Buildings

EXHIBIT 4-7
PREGIS - 3 (9/94)
GIS MAP FILES FOR BUREAU OF STATE PARKS

Path Include Sub Directory	Map File .GRA	Date Created	Date Update	Project File Name	Description/Purpose	Request By
1.						
2.						
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22.						
23.						

EXHIBIT 4-8
PREGIS - 3 (9/94)
GIS MAP FILES FOR BUREAU OF STATE PARKS

Path Include Sub Directory	Map File .GRA	Date Created	Date Update	Project File Name	Description/Purpose	Request By
1. Data/PIGIS	BASE.GRA	08-25-94	10-24-94		Public Distribution	Harry Leslie
2. Data/PIGIS	SOIL.GRA	10-25-94			CZM Report	Greg Schrum
3.						
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21.						
22.						
23.						

EXHIBIT 4-9

MAP STANDARDS

Coverage	Symbol Set	Color	Number	Pen	Comments
BNOY					
Park	Carto1.lin	Black	826	.70	Default
County	Carto1.lin	Black	825	.70	
State	Carto1.lin	Black	116	.35	
Lease	Carto1.lin	Black	113	.35	
LOTS					
Paved	Plotter.shd	Red	90	.35	Default
Gravel	Plotter.shd	Black	89	.35	
Trailer	Plotter.shd	Blue	92	.50	
Turf	Plotter.shd	Green	91	.50	
PNDI					
Wildlife	Carto1.shd	Violet	725	.50	
Fish	Carto1.shd	Blue	425	.50	
Terrestrial	Carto1.shd	Green	325	.50	Default
Historic	Carto1.shd	Brown	525	.50	
Community	Carto1.shd	Magenta	625	.50	
Bndy Corn	Municipal.mrk	Black	129	.35	Default
CNTRL					
Benchmark	Oilgas.mrk	Blue	426	.50	
Monuments	Oilgas.mrk	Green	326	.50	
Survey Pts	Oilgas.mrk	Red	226	.35	Default
Army Corps	Oilgas.mrk	Black	126	.35	
TANK					
Aboveground	Municipal.mrk	Red	238	.35	
Underground	Municipal.mrk	Black	138	.35	Default
Struct	Mineral.mrk	Red	222	.35	Point
	Plotter3.lin	Brown	601	.50	Poly
ROADS					
Primary	Plotter3.lin	Red	70	.35	Default
Secondary	Plotter3.lin		42	.50	

Coverage	Symbol Set	Color	Number	Pen	Comments
Unim Gravel	Plotter3.lin		37	.50	
Improve Gravel	Plotter3.lin		38	.50	
Dirt	Plotter3.lin	Brown	549	.50	
Abandoned	Plotter3.lin	Black	49	.35	
Joint	Plotter3.lin	Red	74	.35	
Administrative	Plotter3.lin	Violet	741	.50	
Fire	Plotter3.lin	Magenta	649	.50	
SEWER					
Park	Plotter3.lin	Brown	589	.50	Default
Public	Plotter3.lin	Magenta	689	.50	
Manhole	Municipal.mrk	Blue	429	.50	
Lift Station	Municipal.mrk	Blue	434	.50	
SIGN					
Traffic	Plotter1.mrk		22	.50	Default
Trails	Plotter1.mrk	Brown	521	.50	
Regulatory	Plotter1.mrk		24	.50	
Bulletin Bd	Plotter1.mrk		21	.50	
Information	Plotter1.mrk	Magenta	621	.50	
TRAILS					
Snowmobile	Plotter3.lin	Magenta	677	.50	
Hiking	Plotter3.lin	Green	79	.50	Default
Bicycling	Plotter3.lin	Brown	577	.50	
ATV		Black	77	.35	
Cross Country	Plotter3.lin	Violet	777	.50	
Equestrian	Plotter3.lin	Red	78	.35	
Multi-Use	Plotter3.lin	Blue	80	.50	
Downhill Skiing	Plotter3.lin	Black	877	.50	
Vege	Plotter.lin	Green	7	.50	Default
Soil	Plotter3.lin	Brown	501	.50	Default
WATER					
Park Line	Cartoln.mrk	Blue	406	.50	Default
Public Line	Carto.lin	Blue	405	.50	
Hydrants	Plotter.mrk	Blue	70	.50	

Coverage	Symbol Set	Color	Number	Pen	Comments
Wells	Plotter.mrk	Blue	92	.50	
Fountain	Plotter.mrk	Blue	100	.50	
Shutoff	Plotter.mrk	Blue	76	.50	Default
WELLS					
Gas	Plotter.mrk	Green	91	.50	
Oil	Plotter.mrk	Red	90	.50	
Monitor	Plotter.mrk	Black	89	.50	Default
Wetlands	Plotter.lin	Green	95	.50	Default
Ponds	Plotter.lin	Blue	88	.50	Default
EROSION					
Breakwaters	Plotter.shd	Red	85	.35	
Groins	Plotter.shd	Brown	561	.50	Default
Getty	Plotter.shd	Red	62	.38	
Rip Rap	Plotter.shd	Violet	761	.50	
Gabion	Plotter.shd	Black	61	.35	
HUNT					
No Hunt	Plotter.shd		65		
Safety	Plotter.shd		66		
Duck Blinds			67		
TOPOGRAPHY					
Contours	Carto.lin	Green	317	.50	Default
ESA	Carto.snd	Green	325	.50	Default
TELEPHONE					
Underground	Plotter3.lin	Brown	521	.50	
Aboveground	Plotter3.lin	Magenta	721	.50	
ELECTRIC					
Park Above	Plotter3.lin	Green	99	.50	
Park Under	Plotter3.lin	Blue	100	.50	
Public Above	Plotter3.lin	Red	98	.35	
Public Under	Plotter3.lin	Brown	597	.50	Default
Metey	Municipal.mrk	Black	113	.35	
Pole	Municipal.mrk	Black	109	.35	
Transformer	Municipal.mrk	Black	106	.35	

Coverage	Symbol Set	Color	Number	Pen	Comments
Cut Off	Municipal.mrk	Black	102	.35	
R-O-W					
Gas	Plotter3.lin	Violet	793	.50	
Oil	Plotter3.lin	Magenta	693	.50	Default
HISTORIC					
Buildings	Mineral.mrk	Red	221	.35	Default
Structures	Mineral.mrk	Blue	421	.50	
Sites	Mineral.mrk	Green	321	.50	
Districts	Plotter.shd	Violet	757	.50	
MGT UNITS					
Lakes	Plotter1.shd	Blue	80	.50	
Day-Use	Plotter1.shd	Red	66	.35	
Overnight	Plotter1.shd	Brown	565	.50	
LDA	Plotter1.shd	Magenta	665	.50	
Administrative	Plotter1.shd	Violet	765	.50	
Nat. Area	Plotter1.shd	Green	79	.50	
ON-LOT					
Septic	Plotter1.shd	Black	57	.35	Default
Leech	Plotter1.shd	Brown	557	.50	
Sand Mound	Plotter1.shd	Green	59	.50	
RAILROAD					
Active	Plotter3.lin	Red	86	.35	Default
Inactive	Plotter3.lin	Brown	588	.50	
ARCHAEOLOGICAL					
Medium	Carto.lin	Blue	425	.50	
High	Carto.lin	Red	225	.35	
BUILDINGS					
Administrative	Cartol.shd	Red	221	.35	
Pulblic	Cartol.snd	Violet	721	.50	Default
Residence	Cartol.shd	Green	321	.50	
Lease	Cartol.shd	Magenta	621	.50	
Private	Cartol.shd	Black	121	.35	

*Default is the standard used when not plotting all the individual attributes in each coverage.

These specifications are meant to be dynamic, refined, and adjusted with experience as the initial program is developed within BSP. The original color, line, and size has been developed for use with a eight pen plotter. If the BSP upgrades to an inkjet plotter revisions will have to be made because of the additional flexibility.

5.0 Budget

The budget for the project was divided into three areas. Approximately 55% of the initial budget went to map preparation and the remaining 45% was to be spent on equipment and technical services. Exhibit 5-1 shows the proposed budget and actual expenditures.

6.0 System Evaluation

This section discusses the system development, capability of producing up-to-date base maps, utility in normal day-to-day operation, applicability to other resources agencies, and future recommendations for applications.

6.1 Development

The development of Presque Isle State Park GIS program has progressed fairly well since BSP, Resource Management Section staff did not know what a GIS program was two years ago. The first year of the project was just a learning experience and acquiring hardware and software. At the end of the first year BSP realized that GIS was a very powerful system that could save money and time as well as be a terrific management tool. It was also noted that developing a GIS program is a major task. The next step was to establish what would be the basic coverages for Presque Isle State Park (Exhibit 6-1). The second year of project was devoted to developing the coverages and writing problems with the coverages. Exhibit 6-2 shows the status of the coverages as of October, 1994. As noted, all of coverages are not completed but are scheduled to be finished with the available information with the Phase II CZM project for the completion of the pilot GIS program. Phase II includes the enhancement of existing coverages, additional coverages, and applications.

As a basic GIS program has been developed for Presque Isle State Park, it is far from being completed. There are so many applications, advances in technology, and additional data needed that the project will never be complete but continue to grow and be enhanced.

6.2 Base Map

The primary objective of the project was to have the ability to produce an accurate base map for Presque Isle State Park. This objective was met with success above the BSP of expectations. Originally BSP figured on digitizing the new boundary of Presque Isle State Park from the 1-400' serial photography the U.S. Army Corp of Engineers provides for April, July, and October annually. This would have enabled BSP to have a new boundary for the base map within 90 days. However, another avenue that was tried during the summer of 1994 was to GPS the shoreline. This method proved to be very acceptable to BSP and allows for a new base map within a day. In addition, BSP will be able to create a boundary map anytime they need it, for example a major storm batters the shoreline and causes major changes shoreline changes. Exhibit 6-3 shows a base map with a 1993 boundary. The base map does not have all the names of the roads, trails, etc. because of the large scale it would be really cluttered. In the Appendix is the same base map drawn at a smaller scale using the same information. Total time to produce these maps was less than 1 hour. If BSP was to do this, the ink and pen method it would have taken two weeks.

EXHIBIT 5-1

92 CZM GRANT BUDGET

Work Elements	Planned Costs	Actual Expenditures
Technical Services	$ 30,000.00	$ 32,514.30
Map Preparation	117,000.00	113,605.28
GIS Equipment	50,000.00	51,207.44
Total	$ 197,000.00	$ 197.327.02

Funding Source	Amount
Federal Share (CZM)	$ 50,000.00
State Funds (BSP)	116,682.25
Oil and Gas Funds	30,644.77
Other	
Total	$ 197,327.02

Summary

GIS Equipment	Amount
Hardware	$ 35,655.25
Software	14,705.00
Supplies	847.19
Total	$ 51,207.44

Technical Services	Amount
ERSI	$ 7,500.00
USGS	15,000.00
EIS	6,062.50
Miscellaneous	2,551.80
Planned Dynamics	1,450.00
Total	$ 32,514.30

Map Preparation	Amount
USGS	$ 103,845.00
Travel to Presque Isle State Park to do Mapping	1,540.52
Hired Staff to Create Maps	6,844.66
Planned Dynamics GPS	1,375.00
Total	$ 113,605.28

EXHIBIT 6-1

COVERAGE CONTENTS

Types of Information Contained in Fall Coverage

*Activity Areas (ACT)

- A. Guarded Beach Boundaries
- B. Research Permit Locations
- C. Picnic Area
- D. Ball Fields
- E. Boat Storage Spaces
- F. Valleyball Areas

*Archaeological Points (ARCHX)

- A. Points

*Archaeological Areas (ARCH)

- A. Areas

*Buildings (BLDG)

- A. Administrative
- B. Public
- C. Residences
- D. Lease
- E. Private

*Environmental Sensitive Areas (ESA)

Areas of Natural Resource Interest

*Electric (ELEC)

- A. Park Lines
  - 1. Aboveground
  - 2. Underground
- B. Public Lines
  - 1. Aboveground
  - 2. Underground

*Electrical Points (ELECX)

- A. Transformers
- B. Meters
- C. Cutoffs

*Rights-of-Ways/Easements (ROW)

- A. Gas
- B. Oil

*Historic Sites (HIST)

- A. Buildings
- B. Structures
- C. Districts
- D. Sites

*Management Units (MGT)

- A. Resource Management Units From the Resource Plan

*On-Line Disposal System (OLDS)

- A. Septic Tanks
- B. Leech Fields
- C. Sand Mounds

*Railroads (RAIL)

- A. Active
- B. Inactive

*Pennsylvania Natural Diversity Inventory (PNDI)

- A. Wildlife
- B. Fish
- C. Terrestrial
- D. Historic Areas
- E. Natural Communities

*Park Boundary (BNDY)

- A. Park Boundary
- B. Township/Borough
- C. County/State
- D. Lease

*Park Boundary Description (BDYCOR)

- A. Corner Numbers
- B. Bearings
- C. Corner Description

EXHIBIT 6-1

(Continued)

*Parking Lots (LOTS)

- A. Paved
- B. Gravel
- C. Trailers

*Roads (ROAD)

- A. Primary
- B. Secondary
- C. Gravel Improved
- D. Gravel Unimproved
- E. Dirt
- F. Abandoned
- G. Joint
- H. Administrative
- I. Fire

*Sanitary Sewer System (SEWL)

- A. Park Line
- B. Public Line

*Sanitary Sewer System Points (SEWX)

- A. Manholes
- B. Lift Station

*Survey Control Points (CNTRL)

- A. Benchmarks
- B. Monuments
- C. Survey Control Points
- D. Army Corp Control Points

*Soils (SOIL)

- A. Soil Survey Information

*Signs (SIGN)

- A. Traffic
- B. Trails
- C. Information
- D. Regulatory
- E. Bulletin Board

*Structures Point (STRUP)

- A. Picnic Tables (optional)
- B. Park Benches
- C. Memorials
- D. Charcoal Grills
- E. Radio Towers
- F. Monuments
- G. Train Cans
- H. Dumpsters
- I. Lifeguard Chairs
- J. Bouys

*Structures (STRU)

- A. Docks
- B. Marina Piers
- C. Gates
- D. Underwater Hazards
- E. Bridges
  - 1. Pedestrian
  - 2. Vehicular
    - a. One Lane
    - b. Two Lane
    - c. Four Lane
  - 3. Combination

*All Tanks (TANK)

- A. Underground
- B. Aboveground

*Trails (TRAIL)

- A. Snowmobile
- B. Hiking
- C. Bicycling
  - 1. Mountain Bike
  - 2. Standard Bike
- D. ATV
- E. Cross Country Skiing
- F. Equestrian
- G. Multi-use
- H. Exercise
- I. Downhill Skiing

EXHIBIT 6-1

(Continued)

*Vegetation (VEGE)

- A. Overstory
- B. Understory
- C. Exotic Species

*Water System and Distribution (WATERX)

- A. Park
  - 1. Hydrants
  - 2. Wells
  - 3. Fountains
  - 4. Shutoffs
- B. Public

*Water System and Distribution (WATER)

- A. Park
- B. Public

*Wells (WELL)

- A. Ground Monitor Wells
- B. Gas Wells
- C. Oil Wells

*Wetlands (WET)

*Ponds (POND)

- A. Lagoons
- B. Ponds

*Erosion Control (EROS)

- A. Breakwaters
- B. Groins
- C. Jettys
- D. Rip Rap
- E. Gabion Baskets

*Hunting (HUNT)

- A. No Hunting Areas
- B. Safety Zones
- C. Duck Blinds

*Topography (TOPD)

- A. Contour Lines

*Telephones (TELE)

- A. Telephone Lines
  - 1. Aboveground
  - 2. Underground

Presque Isle Coverage Status

Presque Isle Status Report

Report Date: 10/26/94

Coverage Descriptor	Cover Name	Cover Type	Digitized	Projected	Rubber Sheeted	Build/ Cleaned	Attributed	Comments
Activity Areas	bndry	annotation	n/a					
Archeological Areas	Archepol	poly	no					data collected from museum
Archeological Points	Archepoi	point	no					
Breakwaters	brkwater	point	yes	yes	yes	yes	not needed	
Buildings	bldgs	poly	8/10/94	yes	yes	yes	yes	have some GPS bldgs to add
Electric	electric	point	no					
Environ. Sensitive	Environ	poly	no					need the 12 areas ID in Ohio report
Gas & Oil Lines	Utilines	line	no					
Groins	groins	line	yes	yes	yes	yes	yes	
Historical Sites	Historic	point	no					
Lagoons/breakwater	lagoons	poly	yes			yes	yes	
Management Units	man_unit	poly	no					can be created from vegetation map
On-lot Disposal Systems	olds	point	no					
PA Natural Diversity Inventory	PNDI	poly	gps data					hold for Phase II: use ESA's
Park Boundary	bndyspfn83	poly	8/10/94	yes	yes	yes	yes	
Park Corners	bndrycor	point	no					not applicable
Parking Lots	parking	poly	yes	yes	yes	yes	yes	
Railroads	Rails	line	n/a					none in Presque Isle Park
Roads	roadutmol	line	yes	yes	yes	yes	yes	
Sanitary Sewer lines	Sansew	line	no					
Sanitary Sewer Manholes	Manholes	point	no					
Signs	signs	point	yes	yes		yes	yes	
soils	soils	poly	yes	yes	yes	yes	yes	needs attribs from anno
Stormwater Collection System	Strmsew	line	n/a	n/a	n/a	n/a	n/a	none in Presque Isle Park
structures - Points	strucpoi	point	no	yes	yes	yes	no	
Structures - Polygons	strucpol	poly	no	yes	yes	yes	no	
Survey Control Points	srvcntrl	point	yes					
Tanks (Underground Storage)	tanks	point	no					
Trails	trails	line	yes	yes	yes	yes	yes	
vegetation	vege	poly	yes	yes	yes	no	yes	need look-up table
water distribution lines	Water	line	no					
water fire hydrants	Hydrants	point	yes	yes	yes	yes	yes	combine into one coverage
Water supply wells	Wells	points	n/a					none in Presque Isle Park
wetlands	wetlands	poly	no					can create from vegetation

6.3 Erosion/Deposition

One of the primary application of the Presque Isle State Park GIS program is to figure the amount of sand deposition and erosion. Exhibit 6-4 is the program in Arc Info that figures the amount of sand lost and gained and shows you where it occurred. Exhibit 6-5 is the result of running this application and comparing shoreline changes between July 1987 and April 1993.

This program will be converted to Arc View 2 and designed as a pull down menu for use by the park.

6.4 Special Maps

The biggest visual ability of Presque Isle State Park staff with the GIS program is to produce any type of map at any scale using a mix of the available coverages. For example, listed below are maps that could be produced for the public or park use.

Group	Coverages Used
Boaters	Hydrographic and Base
Hunters	Facilities, Topographic, and Hunting
Utility Companies	Facilities, Vegetation, Wetland, Soils, Topographic, Archaeological, and Rights-of-Way
Hikers	Topographic, Facility, and Water
Fisherman	Topographic and Hydro
Researchers	Vegetation, Soils, and PNDI
Contractors	Geology, Topographic, and Hodry, Arcnaelogical
Maintenance Staff	Grails, Vegetation (Query done on what was mowed in the last 3 weeks)
Park Rangers	Roads, Trails (To show patrol routes) Buildings

6.5 Environmentally Sensitive Area

The Environmentally Sensitive Area Coverage was created using existing mapped data produced in the RBA Group Study of 1989. Digital data files produced for the RBA study were acquired in a raster OSU-MAP format. In order to import the files into Arc Info, a second GIS package called IDRISI (produced by Clark University) was used to convert the OSU-MAP files to Arc Info format.

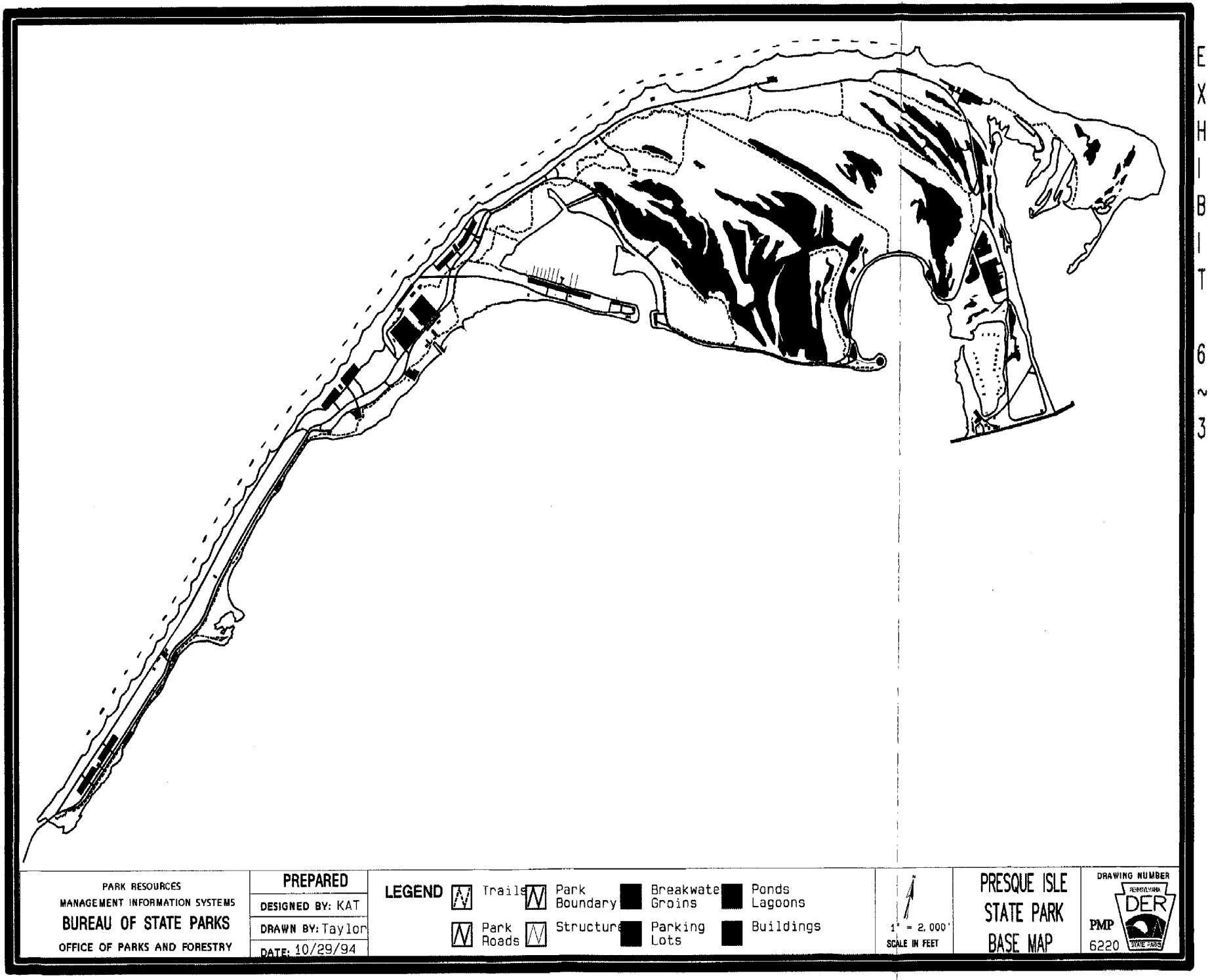

PARK RESOURCES
MANAGEMENT INFORMATION SYSTEMS
BUREAU OF STATE PARKS
OFFICE OF PARKS AND FORESTRY
PREPARED
DESIGNED BY: KAT
DRAWN BY: Taylor
DATE: 10/29/94
LEGEND
Trails
Park Boundary
Breakwater Groins
Ponds Lagoons
Park Roads
Structures
Parking Lots
Buildings
1" = 2,000'
SCALE IN FEET
PRESQUE ISLE STATE PARK BASE MAP
DRAWING NUMBER
PMP
6220
DER

EXHIBIT 623

EXHIBIT 6-4

SHORELINE.AML

Purpose: *Determines the shoreline change given two shoreline polygon coverage. The change is reported in acres for accretion and erosion. Each of the input coverage representing the boundaries of the park should have only two polygons, the universe polygons and one polygon representing the park boundary. Each time the aml is run two new coverage are produced called accrt_<year> and erosn_<year>. If you want to preserve these coverage rename them before running the aml a second time. The aml will check if they exist and delete them before executing.*

History: *Sally Holbert, March 1, 1994, Original Coding.*

Coverage
ACCRT_%date% - Coverage resulting from the identity command that contains polygons representing accretion.
EROSN_%date% - Coverage resulting from the identity command that contains polygons representing erosion.

```
&type  'This aml requires two input polygon coverages representing the boundary'
&type  'of Presqueisle State Park.  There should only be two polygons in each'
&type  'polygon coverage.'

/*     Determine the amount of acretion.
&sv date = °response 'What is the year of the newest boundary file:'é
&sv inputcov = °response 'Enter the name of the most recent boundary file:'é
&if °exists %inputcov% -coveré &then
       &sv idcovero = %inputcov%
&else &do
       %type %inputcov% does not exists, Check name of coverage and start aml again.
       %goto stop
       &end
&sv idcovact = °response 'Enter the name of the older boundary file:'é
&if exists %idcovact% -coveré &then
       &sv inputcov2 = %idcovact%
&else &do
       &type %idcovact% does not exists'
       &goto stop
       &end

/*     Determine the amount of accretion
&if °exists accrt_%date% -coveré &then
       kill accrt_%date%
identity %inputcov% %idcovact% accrt_%date%
&if °exists erosion_%date% -coveré &then
       kill erosn_%date%
/*     Determine the amount of erosion
identity %inputcov2% %idcovero% erosn_%date%
```

EXHIBIT 6-4

(Continued)

```
/*    Start Arcplot
arcplot
display 9999
&sv mapname °Response 'Enter name for map composition' testmapé
map %mapname%
pagesize 36 24
mapscale automatic

mape accrt_%date%
arcs accrt_%date%
arcs erosn_%date%
shadeset colornames.shd
reselect accrt_%date% polys perimeter < 130000
polygonshades accrt_%date% 30
clearselect
reselect erosn_%date% polys perimeter < 130000
polygonshades erosn _%date% 60
clearselect

/*    Open a cursor to determine total area of erosion
cursor areaero declare erosn_%date% poly rw
reselect erosn_%date% polygon perimeter < 130000
&sv selectset = °extract 1 °show select erosn_%date% poly
&if %selectset% ne 0 &then &do
      &sv counter = %selectset%
      cursor areaero open
      &sv erosionsum = 0
      &do &until %empty%
            &sv erosionsum = %erosionsum% + %:areaero.area%
            &sv eroacres = %erosionsum% / 43560
                  &type %erosionsum%
                  &type %eroacres% eroded acres
                  cursor areaero next
                  &sv counter = %counter% - 1
                  &if %counter% = 0 &then &sv empty = .true.
                        &else &sv empty = .false.
      &end /* &do &until %empty%
&end /* &if %selectset% ne 0 &then &do
/* Set global variables to hold area values
&sv .erosionsum = %erosionsum%
& sv .eroacres = %eroacres%
cursor areaero remove
```

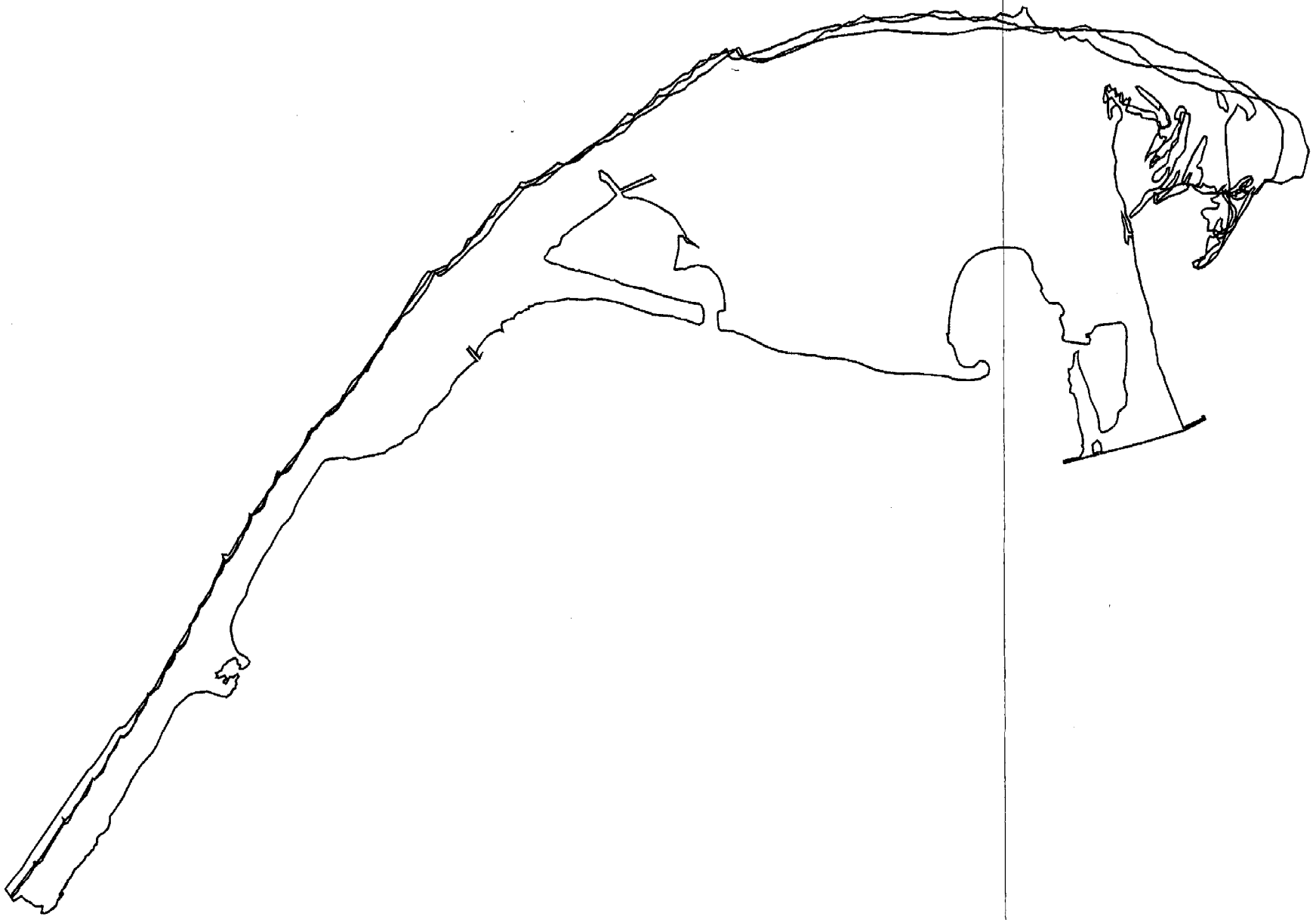
EXHIBIT 6-4

(Continued)

```
/*     Open a cursor to determine total area of accretion
cursor areaacc declare accrt_%date% poly rw
reselect accrt_%date% polygon perimeter < 130000
&sv selectset = °extract 1 °show select accrt_date polyéé
&if %selectset% ne 0 &then &do
      &sv counter = %selectset%
      cursor areaacc open
      &sv accretsum = 0
      &do &until %empty2%
            &sv accretsum = %accretsum% + %:areaacc.area%
            &sv accretsum = %accretsum% / 43560
            &type %accretsum%
            &type %accacres% acres of accretion
            cursor areaacc next
            %sv counter = %counter% - 1
            &if %counter% = 0 &then &sv empty2 = .true.
                  &else &sv empty2 = .false.
      &end /* &do &until %empty2%
&end /* &if %selectset% ne 0 &then &do
/* Set global variables to hold area values
&sv .accretsum = %accretsum%
&sv .accacres = %accacres%
&lv
cursor areaacc remove

/* Create Legend
textsize .35
keybox 1.5 1
keyposition 28 15
keyseparation .25 1
keyshade shoreline.key
/* Report Accretion and Erosion Totals
textsize .35
move 30 14.5
text °truncate %.accacres%é
move 31.5 14.5
text 'acres of accretion'
move 30 12.5
text °truncate %.eroacres%é
move 31.5 12.5
text 'acres of erosion'

&label stop
&type stopping execution
```



PARK RESOURCES
MANAGEMENT INFORMATION SYSTEMS
BUREAU OF STATE PARKS
OFFICE OF PARKS AND FORESTRY

PREPARED
DESIGNED BY: KAT
DRAWN BY: GAJ
DATE: 10/29/94

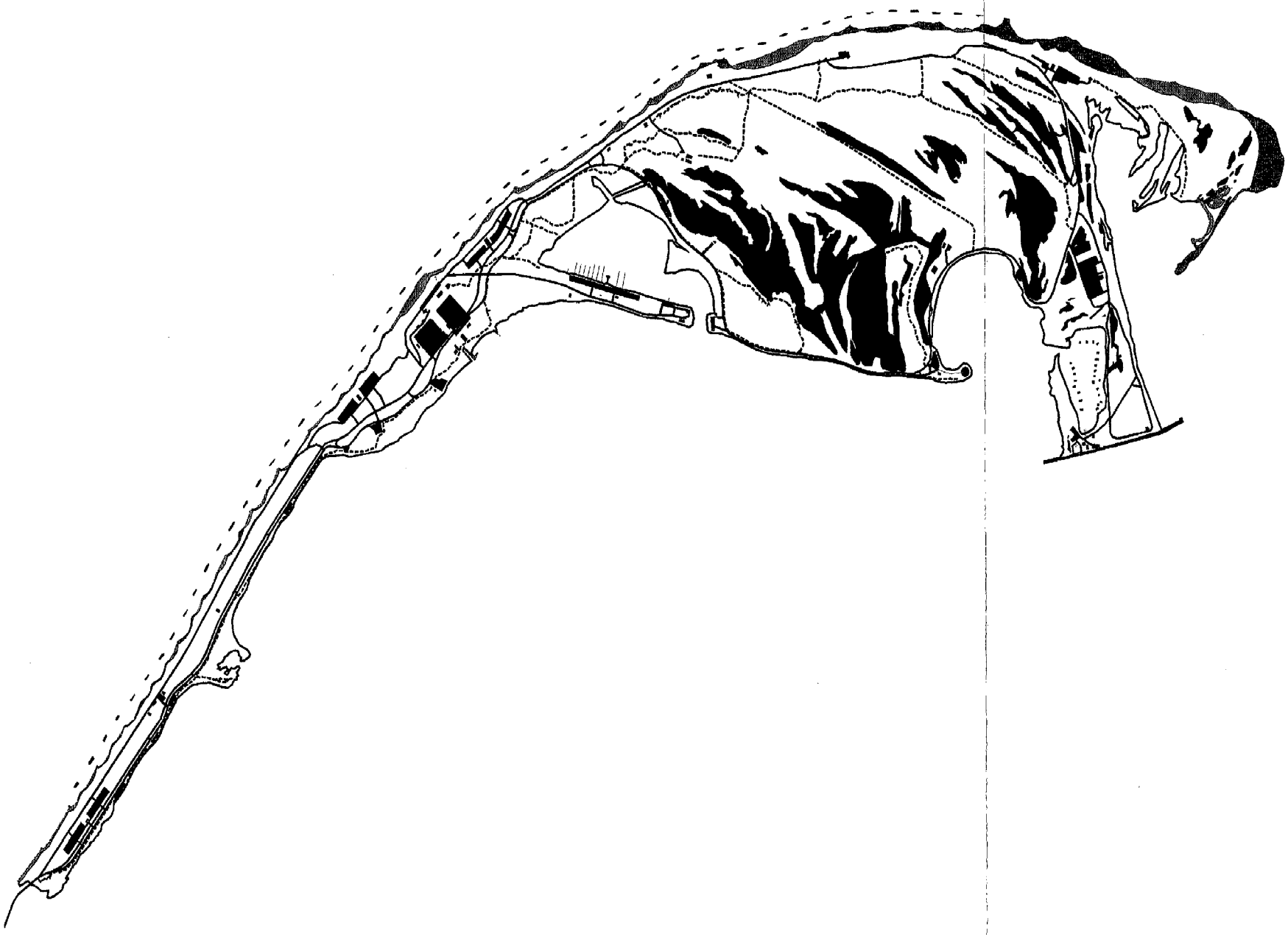
LEGEND
1973 Shoreline
1993 Shoreline
1987 Shoreline

1" = 2,000'
SCALE IN FEET

PRESQUE ISLE STATE PARK SHORELINE MAP

DRAWING NUMBER
PMP
6220

EXHIBIT 6-5



PARK RESOURCES
MANAGEMENT INFORMATION SYSTEMS
BUREAU OF STATE PARKS
OFFICE OF PARKS AND FORESTRY

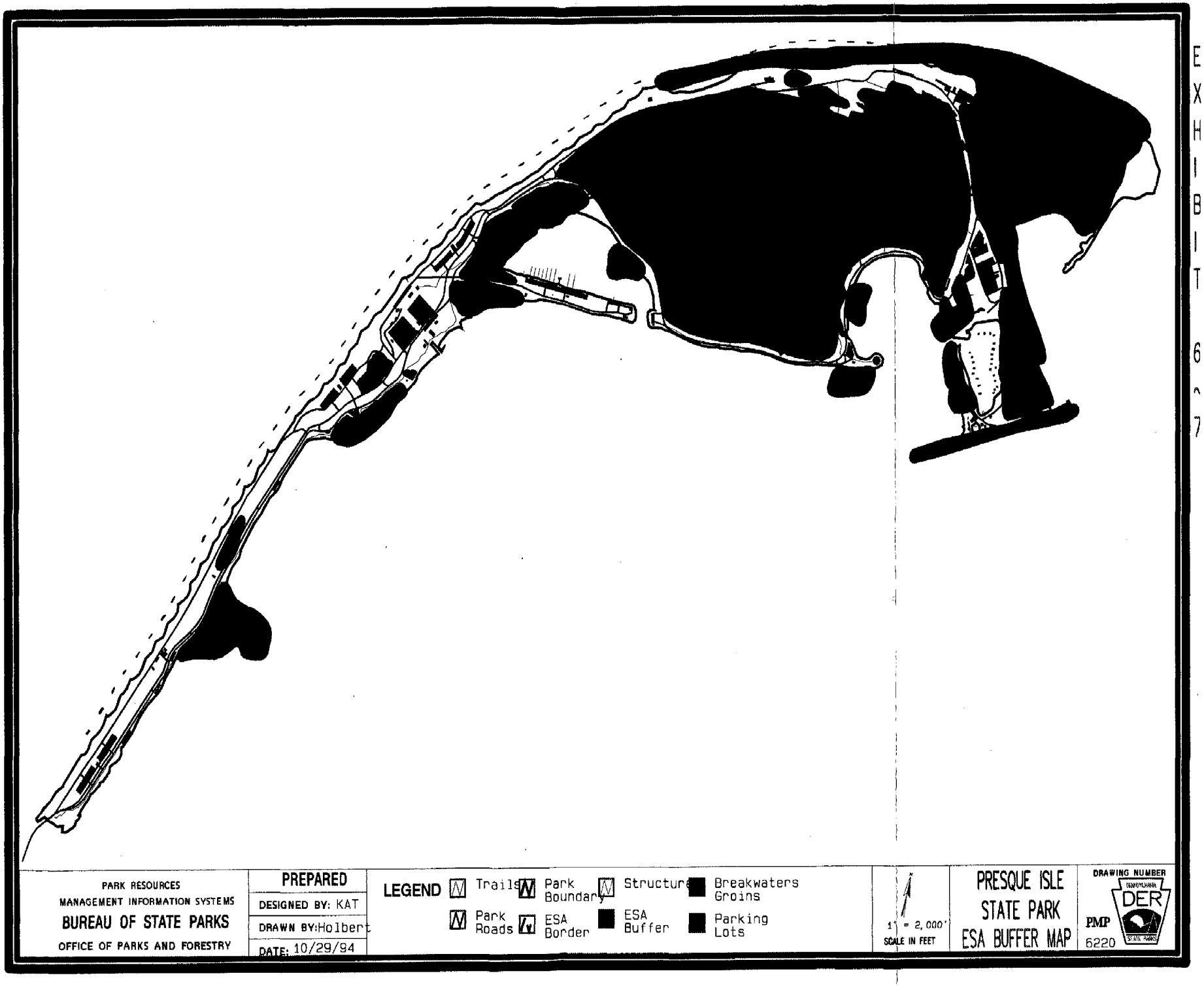
PREPARED
DESIGNED BY: KAT
DRAWN BY: Holbert
DATE: 10/29/94

LEGEND
47 acres of sand accretion
39 acres of sand erosion

1" = 2,000'
SCALE IN FEET

PRESQUE ISLE STATE PARK SHORELINE ANALYSIS

DRAWING NUMBER
PMP
6220



PARK RESOURCES
MANAGEMENT INFORMATION SYSTEMS
BUREAU OF STATE PARKS
OFFICE OF PARKS AND FORESTRY

PREPARED
DESIGNED BY: KAT
DRAWN BY: Holbert
DATE: 10/29/94

PRESQUE ISLE STATE PARK ESA BUFFER MAP

DRAWING NUMBER
PMP
6220

EXHIBIT 6 of 7

After evaluating the data in Arc Info it was decided to produce a new digital data file of the ESAs directly in Arc Info by digitizing the hard copy map of the ESA areas. This produced a better quality coverage compared to the digital data file converted from OSU-MAP format to a vector format in Arc Info. When files are converted from a raster (grid cells) format into a vector format, the boundaries of polygons take on a stair step effect instead of a smooth line.

Using the analytical capabilities of Arc Info a buffer was generated 50 feet around each of the zones represented by polygons in the ESA coverage to produce a buffered coverage called EXANRD 83. If needed for park management purposes, different buffer distances based on the degree of protection required for each ESA zone can be generated. Exhibit 6-7 shows this buffer.

6.6 Other Resource Potential Use

Most of the coverages created for the Presque Isle State Park will be of use to other resource management agencies listed below. Certain coverages, such as historic sites, archaelogical sensitive areas, and species of special concern, will be restrictive use to other agencies. This is required by the sensitivity of the item, regulations, and/or letters of agreements between agencies. Exhibit 6-8 is an example of letter that was need to obtain information.

All of hardware and software acquired is compatable with the types of equipment used by PA DER as well as federal agencies. The data collected used guidelines from other agencies responsible for similar types of data. BSP did not want to recreate the wheel or develop new standards to replace existing ones. The BSP did make guidelines more restrictive because of the scale they perfered to work at.

PA DER Agencies

- Bureau of Forestry
- Bureau of Waste Management
- Bureau of Water Projects
- Bureau of Land and Water Conservation
- Bureau of Topographic and Geologic Survey

Other Pennsylvania Agencies

- Pennsylvania Emergency Management Agency
- Pennsylvania Game Commission
- Pennsylvania Fish and Boat Commission

Federal Agencies

- National Ocean Atmospheric Administration
- U.S. Army Corps of Engineers
- Soil Conservation Service
- U.S. Fish and Wildlife Service
- U.S. Geological Survey

6.7 Future Applications

The following is a list of future applications being considered for Presque Isle State Park. Applications marked with an asterick are currently under development by the Resources Management Section of BSP for the 93 CZM Project due for completion in 1995.

- Mowing schedule with height and time restrictions for maintenance.*
- Water shut location and type for maintenance.*
- Sign location, replacement, and for maintenance and administration.
- Exact Location of PNDI species for administration, maintenance and ranger functions.
- One foot contour map for administration to show lake level effects (BSP has 65% of Park in Hardcopy Maps).*
- Rights-of-Way maps for administration.
- Houseboat inspections for administration.
- Exotic species areas of concern for administration.
- Monument location for administration.*
- Historic shoreline erosion for administration and environmental education.
- Pump preventive maintenance for maintenance.
- Breakwater maintenance plan for maintenance.
- Marina reservations for administration.
- Bouy placement for ranger activities.

7.0 Recommendations

The following is a list of recommendations that will be made to BSP senior staff for enhancement of the GIS program and implementation statewide.

- To use State Plane, NAD 83 as the standards projection for state park maps.
- To establish a GIS coordinator to oversee the GIS program in BSP.
- To require a inkjet plotter for maps upto 17" x 11" in size.
- To use GPS equipment for collecting of data within the park boundary. The 1-2 meter accuracy will be a major improvement in the quality of state park maps and will be an acceptable error factor.
- To use the Department's cardiographic section to digitize existing accurate maps into Auto Cadd for use by Resources Management Section. The Resources Management Section will use Arc CAD to take maps between Arc Info and Auto CADD.
- To acquire Arc CAD and Arc Scan modules for Arc Info for use with the GIS program.
- To take the information from this project and Phase II and develop a Geographic Information System Plan for the Bureau of State Parks before continuing with future applications.

EXHIBIT 6-8
PENNSYLVANIA HISTORICAL AND MUSEUM COMMISSION LETTER

COMMONWEALTH OF PENNSYLVANIA
Department of Environmental Resources
June 29, 1994

In Reply Refer to:
PF-P-RM

SUBJECT: Archaeological and Historical Sites
Presque Isle State Park

TO: Kurt Carr
Chief
Division of Preservation Services
Pennsylvania Historical and Museum Commission

FROM: Roger Fickes
Director
Bureau of State Parks
Department of Environmental Resources

This memo is in reference to the confidential historical and archaeological site information/data for Presque Isle State Park.

The information received from the PA Historical and Museum Commission on historical and archaeological sites in Presque Isle State Park is for official use only and will not be provided to the general public or any other agencies. The data will remain with the Bureau of State Parks as part of the Geographic Information System (GIS) that is being developed for Presque Isle State Park for resource management planning and administrative purposes.

If you have any questions, please contact Keith A. Taylor of the Resources Management and Planning Division at (717) 783-3305.

bcc: Park Region 2
Presque Isle State Park
Presque Isle GIS
Daily
File

RF:GMS:JPB:KAT:jd

APPENDIX

PI Coverage Dictionary
DLG Map
GPS Summary Sheet

Presque Isle Coverage Dictionary

Coverage Descriptor	Print Area Name	B1:I157 Type	Attribute Descriptor	Attribute Name	Attribute Definition	Allowable Values	Comments
Archeological Areas	Archeo	poly	site name	name	c,30		
			site id no.	site_id	c,9		
			site descrip	descrp	c,40		
Buildings	bldgs	poly	bldg type	type	c,9	admin,public,residence	
				use	c,20	change house,restroom,cabins	
			bldg id number	id	c,8		
			building name	name	c,25		
			floor space (sq. ft.)	floor_sp	n,5.0		
			Building Material	bldgmatl	c,1	see LUT for codes	
			building condition	cond	c,1	see LUT for codes	
			No. of Months of Use	mo_use	n,2.0	months per year?	
			type of heating	heat	c,3		
			hot water	hoth2o			
			year bldg constructed	yr_built	c,4		
				hist_reg	c,3		
				hist_use	3,c		
			trim painted	trim	n,5.0		
			year trim last painted	trim_yr	n,4.0		
				ex_wood	n,5.0		
				ex_wd_yr	n,4.0		
				int_wood	n,5.0		
				in_wd_yr	n,4.0		
				masonry	n,5.0		
				yr_mason	n,4.0		
				roof	n,5.0		
				yr_roof	n,4.0		
				day_nite	c,2		
				roof_pit	c,4		
				electric	c,3		
				plumbing	n,2.0		
				leased	3,c		
				maintain	3,c		
				showers	3,c		
Electric	electric	point		pole-id	c,8		
				trnsform	i,3	NO or KW rating	
				power	i,3	KW rating	
				cut-off	c,1	Y or N	
			Service To	serves	c,15		

Presque Isle Coverage Dictionary

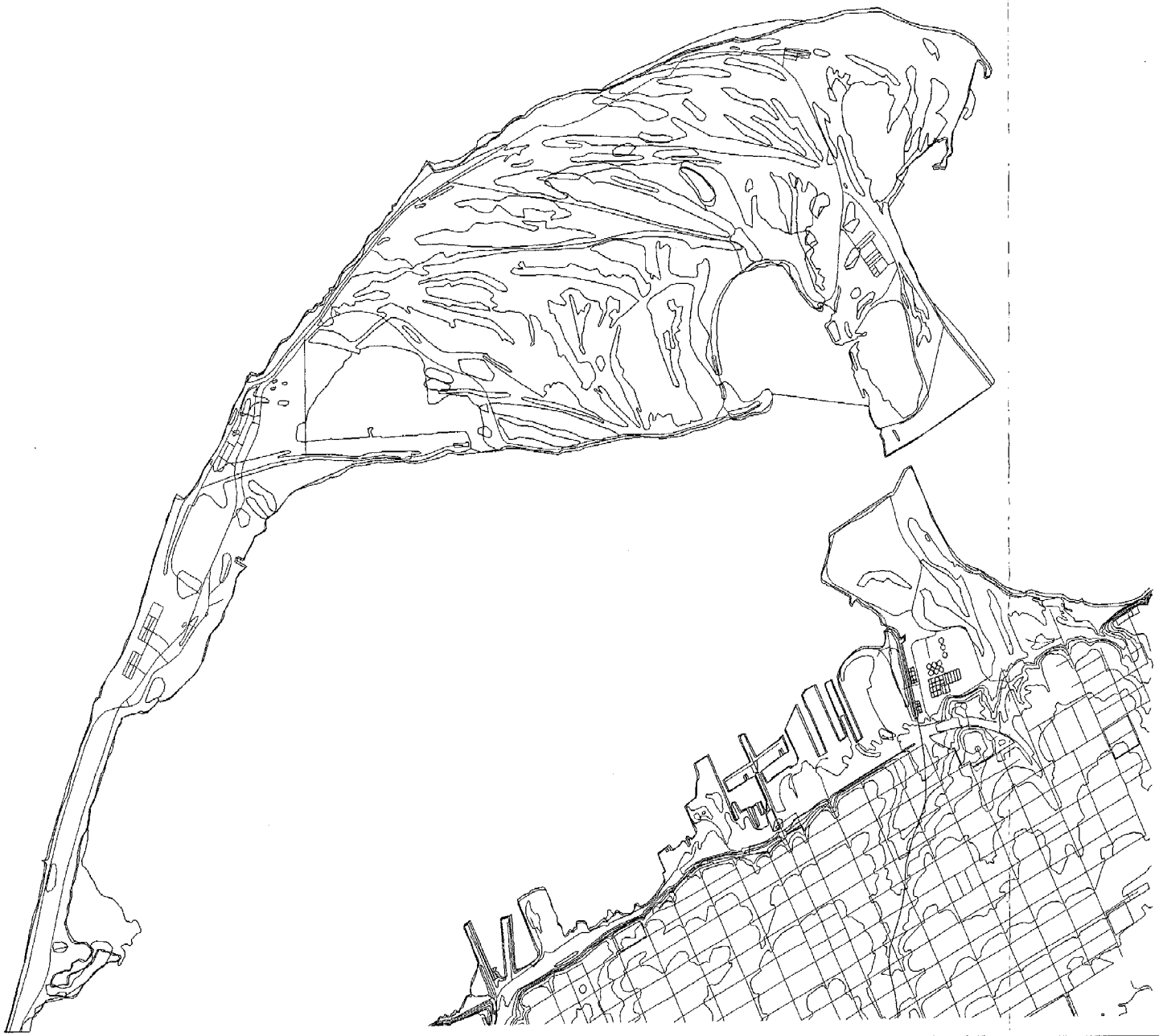
				locatn	c,1	O (overhead) or U (underground)	
Environ. Sensitive	Environ						
Gas & Oil Lines	Utilines	line		owner	c,18		
				type	c,6		
Historical Sites	Historic	point	Site Name	name	c,24		
			Description	descrp	c,40		
Management Units	man_unit	poly					
	mgmtunit	poly	unit-id number	unit-id	c,8	4801.000 thru 4806.000	
On-lot Disposal Systems	Olds	point	Type system	type	c,16		
			Tank Size	tankvol	n,4.0		
			Field Size	fieldsiz	n,5.0		
			Date Installed	dateinst			
Park Boundary	bndry	poly	owner	owner	c,4	twp.,boro,cnty,stat,city	
			ownership	type	c,6	lease,own	
Park Corners	bndrycor	point	corner No.	cor_id	c,5		
			description	cor_desc	c,40		
Parking Lots	parking	poly	surface	surftype	c,9	paved,gravel	
				use	c,14	auto,trailers	
PA Natural Diversity Inventory	PNDI	poly		eo-code	c,15		
			common name	name	c,25		
			scientific name	scientif	c,25		
				status	c,12	rare,endangered,threatened,undertermined	
				class	c,15	terrestrial,aquatic,wildlife,exotic	
			museum number	museum	c,9		
Railroads	Rails	line	Name of Railroad	owner			use item sizes from R2T files
			Name of Rail Line	linename			
	roads	line	Prefix (North,South)	roadpre	c,2		
			Name of Road	roadname	c,18		
			Road Type	roadtype	c,4	ST,LN,BLVD,AVE,CT,	
Roads			class	class	c,9	primary,secondary	
			surface	surftype	c,18	gravel:improved, asphalt	
						gravel:un-improved, concrete	
						earth	
			status	status	c,9	in-use	
						abandoned	

Presque Isle Coverage Dictionary

Signs	signs		Sign Post Material	post	c,12	steel channel,wood 4X4,	
						wood 6X6,concrete,steel pipe,	
						gate mounted,other	
			Reflective	reflect	c,1	y or n	
			Height	height	c,3		
			Sign Material	sign	c,12	routed wood,metal,plastic	
						plywood, other	
			Date Installed	dateinst	c,8	YY/MM/DD	
			Sign's Message	text	c,25		
			Owner	owner	c,18		
				comment	c,30		
			sign class	class		destination,information,	
						environmental interpretive,	
						traffic,special,other	
				multiple	c,1	Y or N	
soils	soils	poly					
Stormwater Collection System	Strmsew	line	Line ID no.	id	c,9		
			material type	type	c,12		
			pipe diameter	diameter	n,4.1		
			invert elev. upstream	inv_up	n,7.2		
			Invert elev. down stream	inv_dn	n7.2		
structures	struc	point	structure identification no	struc_id	c,9		
			structure type	type	c,18		
Survey Control Points	srvcntrl		Point ID no.				
Tanks (Underground Storage)	tanks	point	Tank ID no.	tank_id	c,9		
			Legal Owner of Tank	owner	c,24		
				contents	c,15	gasoline, diesel fuel, etc.	
Trails	trails	line	trail use	use	c,10	snowmobile,hiking,	Codes field with LUT
						bicycling,atv,skiing,equestrian	
						exercise,cross-country	
			type construction	constr	c,10	asphalt,concrete,unpaved,other	

Presque Isle Coverage Dictionary

			trail width	width	c,3		
			trail name	name	c,15		
vegetation	vege	poly	vege type	type	c,1	A,B,C,D,E,F,K,P	
			Site Class	siteclas	c,3	I,II,III	
Wastewater Collection system			Size/Stocking Class	sizeclas	c,1	12345678	
Sanitary Sewer	Sansew	line	Line ID no.	id	c,9	Use upstream manhole ID	
			material type	type	c,12		
			pipe diameter	diameter	n,4.1		
			invert elev. upstream	inv_up	n,7.2		
			Invert elev. down stream	inv_dn	n7.2		
Manholes	Manholes	point	Manhole ID no.	id	c,9		
			rim elevation	rim_ele	n,7.2		
			invert elevation	inv_ele	n,7.2		
			Manhole Type	type	c,	pre-cast,brick,other	
Water Distribution system							
distribution lines	Water	line	material type	type	c,9		
				diameter	c,5		
fire hydrants	Hydrants	point		id	c,5		
Water supply wells	Wells	points	Well ID no.	well_id			
				owner	c,24		
wetlands	wetlands	poly	Wetland Type	type	c,2	U1,U2,U3,U4	
Activity Areas	bndry	annotation					



PARK RESOURCES
MANAGEMENT INFORMATION SYSTEMS
BUREAU OF STATE PARKS
OFFICE OF PARKS AND FORESTRY

PREPARED
DESIGNED BY: KAT
DRAWN BY: USGS
DATE: 10/29/94

LEGEND
Political Boundaries
Transportation lines
Contours
Hydrography

1 = 2,200
SCALE IN FEET

PRESQUE ISLE STATE PARK USGS DLG MAP

DRAWING NUMBER
PMP
6220

EXHIBIT A ~ 1

SUMMARY SHEET FOR PRESQUE ISLE GPS PROJECT

JULY 25-29, 1994

Weather: Clear to partly cloudy skies with temperatures in the high seventies.

Worked on GPS from 8:00 a.m. to 5:00 p.m.

Signs: The signs were taped on the lower left corner to signify that the sign was logged on the data logger. The data dictionary was set up so that the date for the sign installation was automatically generated by the computer. This could have proved to be a bigger problem if the attribute was located in the middle of the data menu. One could not press enter when the date appeared. The next step was to feature off of signs. If the date was in the mideele of themenu, it is unsure of what the procedure would be, possibly moving to the next attribute would work. The only GPS unit problem was a defective battery that would not stay charged. Definitely need two or three people doing singn, with two units working on the feature. Total hours spend collecting was 13.5.

Shoreline: A tree was marked to set a marker on beach 10. There were several times when there was not enough satellites available or the PDOP was too high. Did not use data dictionary because the basic unit was used. An ATM was used and the shoreline was done twice in a relatively short period of time. The second trip on the shoreline was better because more satellites were available. Did some bay points and used a truck for transportation. We walked along the concrete structures along Perry's Monument, the West Pier, the East Pier and by the Coast Guard Station. Shoul have created a data dictionary for shore points for the bay side and then we could have used the pro and added attribute information. Total hours collecting data was 18 with three hours on gull point.

Water Utilities: No markers were set. Feature selected itself several times and the key pad was never touched. No problems with the data dictionary. Could not stand right next to the building when data logging spigots and fountains. Total hours collecting data was 26.

Trails: GPS equipment was not hooked up properly and got "NO GPS RESPONSE" message. We checked our connections and then continued. Have to make sure that everyone knows how to feature off of an intersection within the trail feature. The basic machine was also used for trails and worked very well. Fox Trail could not be connected so there is a portion in the middle that is missing. Have to use an ATM or the trails would not get done. Total hours collecting data was 42.5.

PNDI: No markers were set. Need to use range poles instead of the backpacks. Should have crated a feature for wetlands, because a few areas were recorded as terrestrial. Cannot pause data logger for more than two minutes. Total hours collecting data was 24.

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